THE

ELECTRICAL REVIEW.

VOL. LXXV. DECEMBER 11, 1914. No. 1,933.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: December 11, 1914. [No. 1,933.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.
BERLIN: Asher & Co., Unter den Linden; Speyer & Peters, Unter den Linden 43, N.W. 7.
BRISBANE: Gordon & Gotch, Queen St.
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JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

ELECTRICITY AND CIVILISATION.

IN his address to the Birmingham Local Section of the I.E.E., Dr. A. H. Railing makes a striking departure from the beaten track. Taking the broadest view of human society and its environment from the dawn of history to the present day, he endeavours to trace the progress of civilisation from its rudimentary beginning and to show that electrical engineering, by virtue of its unique characteristics, sets the crown upon the work. Naturally the development of society and civilisation proceeded from the simple to the complex, involving the early introduction of specialisation and the study, more and more minute and detailed, of divergent branches of knowledge; it is curious to note, however, that the progress of engineering science, on the other hand, has taken place in the opposite direction, commencing with the study of astronomy and passing through gravitation to dynamics, and so on to the properties of the molecule, the atom, and, finally, the corpuscle—the most elementary particle of matter (or rather, electricity). Thus, science has advanced from the infinite to the infinitesimal, from the complex to the simple; yet, strange to say, of that force upon which the mechanism of the whole universe depends, whose operation is familiar to the most primitive barbarian and has been under observation from the beginning of things, of gravitation we know no more than we do of the great mystery of life itself.

Dr. Railing seems to attribute electrical engineering in some way to the knowledge of the corpuscle, for he says: "In engineering we came last to the science of the corpuscle, and its application, electrical engineering"; here we cannot follow his argument, for it is historically the fact that electrical engineering attained to vast proportions before the corpuscle was so much as thought of, and it is not clear to us that the science of the corpuscle has exercised any marked influence upon the progress of electrical engineering; as in many other cases, the application has preceded the explanation. Wheatstone developing the electric telegraph, and Faraday, when he laid the foundations of heavy electrical engineering, knew next to nothing of the corpuscle, and Maxwell erected his magnificent electromagnetic theory on the basis not of particles but of vibrations. The science of the corpuscle no doubt is destined to affect profoundly the future course of electrical progress, but if we take, for example, the *Journal* of the Institution of Electrical Engineers we shall find it mentioned only in a few rare instances. It is difficult, too, to conceive of electricity as the mother of optics, dynamics and chemistry.

As regards the effect of electrical engineering upon human development, however, we are of course entirely in agreement with the author; as he says, "the world is the field of the electrical engineer." In innumerable ways the latter has promoted the well-being of his fellow-creatures, unconsciously perhaps, and without set

purpose, and has immensely increased "the collective efficiency of mankind;" and we cordially endorse the author's remark that this knowledge should be a source of profound satisfaction to him and a spur to increased activity. It is well from time to time to look round us and endeavour to obtain a comprehensive view of our position and our work in the world, and Dr. Railing is to be congratulated upon the happy thought of directing the attention of his colleagues to the sociological aspect of their vocation.

The Thermophone.

In another column we give an abstract of a paper presented to the Royal Society, on the 3rd inst, on "Thermophones." The apparatus shown consists of a loop of exceedingly fine wire, mounted within a metallic case having a small orifice; this in turn is fitted within an ebonite case, or tube, of such size as to be readily inserted in the ear. It acts as an efficient telephone receiver, an ordinary microphone, in circuit with a battery, being employed as a transmitter.

The author traces the origin of thermophones to Sir Wm. Preece, who submitted a paper to the Royal Society in 1880, describing an apparatus in which a wire, under the influence of telephonic currents, vibrated a diaphragm to which it was attached. But an earlier example, and one, moreover, which was actually called "the thermophone," by Theodore Wiesendanger, was described in our issue of October 1st, 1878 (*Tel. Journal*, Vol. VI, page 400). At that time considerable interest was taken in the source of sound in the telephone, the utility of diaphragms, and so on. The possibility of using a microphone as a receiver was shown by Blyth and Hughes, and the almost forgotten carbon receiver of Bell was a subject of discussion. Thermal action was the explanation favoured in all these cases. The thermophone of M. de Lange is directly operated by the variations in temperature set up in the loop, and is an interesting scientific development. M. de Lange claims that his invention is of the greatest practical value, and we note that, as usual, the lay Press has gone somewhat further than the inventor, in one case assuming that the "last word in telephones" has now been said. It will be very creditable to the present age if that be so, but it will be wiser to assume that nature has not yet revealed all her secrets, and that science may still be encouraged to continue research. It may also be wise to remember that the principal use of a telephone receiver at the present day is as part of a very complex system, and that the success of its operation is dependent upon its fulfilling all the operative conditions of that system. The demonstration can only be made satisfactorily by those acquainted with the requirements and provided with the necessary facilities. We think, therefore, that any statement regarding the practical advantages of the device should be reserved, and in the meantime congratulate M. de Lange on the development of the thermophone principle culminating in an instrument of much scientific interest.

Australian Tramway Arbitration Awards.

On December 21st, 1912, Mr. Justice Higgins, the President of the Commonwealth Court of Arbitration, gave his award in the case of the tramway employés, which had occupied his attention for 93 days. At the time we devoted considerable space to this matter, which was a dispute between the Australian Tramway Employés' Association and eleven of the principal tramway undertakings in the country. It will be remembered that eventually, at the suggestion of the Judge, direct negotiations between the masters and men resulted in voluntary agreements in nine cases, a judicial award being given in the other two, namely, the Brisbane Tramways Co., Ltd., and the Municipal Tramways Trust, Adelaide. Preference as regards employment was given to members of the Association in the case of Brisbane, but this did not form part of the Adelaide award. Objection to the jurisdiction of the Court was made by both the Brisbane and Adelaide tramway authorities, and ever since that date the question of the legality of the awards has been before the Courts. After several misadventures in the way of re-hearings and adjournments, a final decision has been given in the High Court—by three Judges against two—that the awards are invalid. The case commenced in March, 1912, and after two-and-a-half years it is found that the claimants had no *locus standi*. At the first hearing there were more than 5,300 pages of transcripts from shorthand notes, and there seems to be no record of what has been necessary in the two years' proceedings in the High Court. Report states that the Brisbane and Adelaide Tramway authorities have spent from £20,000 to £30,000 in expenses, while the men have spent £5,000. The principal grounds on which the awards have been set aside are, first, that the men's Union had no power to act, since it was not constituted in accordance with the requirements of the Arbitration Act; secondly, that an inter-State dispute in the sense contemplated by the Act had not taken place; and, thirdly, that the grant of preference to the members of the men's Union at Brisbane went beyond the powers conferred by the Act. Several other objections were made, but it will be seen how in the case of determined opponents the best laid plans of compulsory arbitration may go wrong. The Arbitration Act of Australia was framed with the idea of providing a speedy and cheap method of settling industrial difficulties. A special Court for enforcing the Act was constituted, from which lawyers were excluded to save expense. And yet such is the perversity of human nature, that the result is delay and expense worthy the satire of a Dickens. There are reports of grave dissatisfaction on the part of the men with the new position of affairs.

Lead.

While latterly the tone of the lead market has been rather quieter, possibly induced in some degree by the flatter tendency of copper and tin, the position of the metal does not appear to have undergone any sensible alteration. There is only a moderate amount of lead coming forward, and all that arrives seems to be pretty badly wanted, so that there is nothing in the way of an accumulation in progress. Dealers seem to be pretty well satisfied with the position of the metal, and there is, at all events, no disposition to take liberties with the market on the bear tack. On the whole, the consumption going on is quite satisfactory, although necessarily the greater part is in connection with the provision of war requirements. These must be hastened on at all costs, and the supply of ammunition for our troops in the field therefore assumes proportions of vast importance. In spite of the financial and other responsibilities (against which the mining community in Australia and Spain have been battling bravely for some months) production has managed to keep its head above water, though there has necessarily been a considerable reduction in output in all parts of the world. Of course the ordinary consumption has been much retarded by the war, but the demands for military purposes are of supreme importance, and all the belligerent countries are eager buyers. Russia has made immense purchases both in Europe and in America, and further inquiries are in the market from this quarter; efforts have even been made to ship cargoes of lead from Spain to Vladivostock—an unheard-of proceeding. So far it has not been possible to arrange vessels for this voyage, but there is a possibility that something of the kind may mature one of these days. The cost of freight from Spain to Vladivostock would naturally be very high, but this counts for nothing

in the successful pursuit of the Huns. Japan is also a buyer of lead and has done some fair quantities for shipment from the United States to Yokohama, and further purchases are pretty certain to be made. There are inquiries still in the market, indeed, for this destination. There is a good deal of interest taken in the lead position in Germany, and it is known that prices there are much higher than here, which is only natural when it is remembered that Germany imports lead ores and concentrates on a large scale under normal conditions. There is, of course, a tendency in Germany to minimise the effects upon the country's lead supplies, of the blockade of her trade, but the position is one of some scarcity, as is clearly enough shown by the prices ruling there and here, and it is much to be desired that this feature of the situation will be developed considerably. While the United States market was recently very stiff, there has just lately been a rather easier attitude on the part of producers there with the correspondingly increased inclination to export material. It is very doubtful how the position will develop across the Atlantic, however, for there are many considerations to be taken into account, not the least of which is what appear to be some faint signs of returning activity in the steel trade. Should these be confirmed, the entire industrial situation in North America may be altered. As for Mexico, political affairs there seem to be going from bad to worse, and there is not the slightest chance of industrial operations assuming a moderate degree of activity for months to come. There are too many candidates for the Presidency, and too many bands of thieves and robbers masquerading as "armies" for reasonable security to life and property to be in sight.

About a Personal Apology.

There are apologies and apologies. Sometimes nervous and bashful creatures make their excuses so awkwardly that in their eagerness to correct themselves they become more and more involved and confused, and ultimately wish they could vanish out of sight. What is more disconcerting than to have to stammer out an apology for an apology? Yet there are times when this has to be done.

A well-known electrical firm, whom it is not our intention to accuse of either nervousness or bashfulness, thought fit to advertise an apology to readers of our last week's issue. In thus confessing that it had been guilty of "commercial ineptitude," it was acting within its legitimate rights and privileges as an advertiser, and if that had been all, we should not have raised any objection. But, unfortunately, that was not all—not by a long way, for since Friday morning last we have been deluged with communications from all parts of the country consequent upon the widespread circulation of postcards, drawing attention to an apology on a certain page, by the advertiser referred to. These cards, a number of which have been forwarded to us, carried an Electrical Review heading and no other, and were so printed and worded as to convey the impression to those who were unacquainted with our methods that the Electrical Review was offering the recipient an apology for something or other.

It is due to all of our friends, and it is due to ourselves, that we should most emphatically state that not only did we have nothing whatever to do with the issue of the card, but it was done entirely without our knowledge or authority. Furthermore, we must offer the strongest possible objection to the taking of so unwarrantable a liberty with the name and reputation of this journal. We feel reluctant to accuse a maker of foolproof devices of "commercial ineptitude," and under all the circumstances we think that the most charitable construction that we can put upon the matter is that illness and absence from duty, which all of his friends have regretted, were responsible for the oversight which permitted so gross a blunder in publicity methods.

OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

(*Continued from page* 746.)

Protective Gear.

From what has been said it will be clear that, although the over-pressures due to internal causes are usually less severe than those due to atmospheric disturbances, they are at the same time much more varied as to the form they take. Thus (apart from static charges) all atmospheric disturbances may be said to involve either a high frequency or a steep wave front, whereas internal troubles range from a steep wave corresponding to a frequency of perhaps 1,000,000 periods per second, down to resonance with the frequency of supply at say 50 periods per second.

Condensers.—It is evident that condensers are of no practical use for dealing with surges of internal origin, since those involving a steep wave front, which are the only ones against which condensers can be used, form a comparatively small proportion of the total to be dealt with. This is fully admitted by even the most enthusiastic supporters of the condenser, and all are agreed that some form of air gap connected to earth through a resistance is the only effective remedy. The best form of gap and resistance has been the subject of much discussion. but the only patterns which need be considered at the present day are the following:—

The Multi-gap or Wurts arrester.—This arrester, a simple form of which is shown diagrammatically in fig. 10, was at one time very much used in America but has now, largely, been superseded by other patterns except for small installations of comparatively low voltage. It consists of a number of metal cylinders mounted on an insulating base and separated from each other by narrow air gaps. Some two-thirds of the gaps are shunted by a resistance (or by two resistances as shown in fig. 10), the unshunted gaps being so adjusted as to allow sparking over at a pressure exceeding the normal by say 50 per cent. So soon as these unshunted gaps break down the line is put to earth through the resistances, and in the case of an insignificant surge the current so conducted to earth may be enough to relieve the line. In most cases, however, this will not be so, and a further discharge will take place over the shunted gaps. So soon as the surge has passed to earth, and the line current follows as it inevitably will, the resistance shunts the gaps to such an extent that the shunted arcs can no longer be maintained. If the surge P.D. to earth has again fallen to normal the unshunted gaps will be too long to maintain the arcs which will, likewise, be extinguished. The extinguishing of the arcs is materially assisted by the cooling effect of the comparatively large mass of metal in each cylinder. In order to prevent too heavy a discharge to earth a resistance (R) is usually connected in the earth circuit to limit the current.

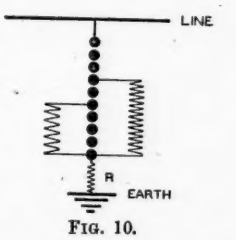


Fig. 10.

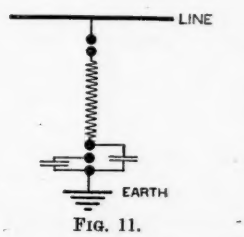


Fig. 11.

The chief advantages of the device lie in its compactness and low first cost, but as has been said, it is

incapable of dealing with any large amount of energy, and if, with a view to doing so, a number of the arresters have to be connected in parallel the advantages disappear. It may be added that the shunting resistance usually consists of a carborundum rod, a drawback to which lies in its liability to break down under repeated discharges.

The Giles limiter or "Valve."—This apparatus, which has been used a good deal in Germany and elsewhere on the Continent, is a multi-gap device based upon much the same idea as the Wurts but somewhat different in construction. It is illustrated in fig. 11. The upper gap is set to spark over with say 50 per cent. excess P.D. to earth. Before a discharge has taken place all the spark gap electrodes are at earth potential (owing to being connected to earth through condensers), except the top one, which is connected to line. Should the P.D. to earth exceed that for which the upper gap is set, a spark will pass over, and this will bring the second and third electrodes nearly to line potential and a spark will pass on to the fourth, and so on till all the gaps are discharging, in series, to earth through the resistance. So soon as the over-pressure has subsided the P.D. across those gaps which are shunted by condensers is insufficient to maintain the arc and the circuit is broken. It has already been shown that a condenser shunting an arc has the effect of breaking it with extreme rapidity, and were it not for the high resistance in series with the gaps, serious trouble might arise through over-pressures caused in this way. The Giles limiter being very similar in principle to the multi-gap arrester suffers from much the same disadvantages, namely, that it can only deal with a comparatively small quantity of energy unless a large number are connected in parallel. Besides being expensive it is fragile and has itself to be protected by means of a fine fuse which may blow without the fact being noticed. It has, on the other hand, the advantage of enabling the spark gap to be accurately set by means of a fine screw thread on the upper electrode and, the gap being enclosed in a glass cylinder, is less liable to disturbance with dust, etc., than is the case with the open multi-gap arrester.

The Horn Gap.—This form of gap, due originally to Siemens, is the oldest and by far the most extensively used form of protective gap. *If properly designed and used* it affords the best form of protection. It was at one time customary to connect horn gaps directly to earth so that when they discharged the line was put to earth, and this would often happen on more than one phase at the same time, thus producing a dead short between lines as well as to earth. When it is added that in the majority of cases the arresters were erected on poles in the open and exposed to short circuits due to snow, insects, twigs, etc., it is little to be wondered that arresters so installed were the cause of many serious breakdowns.

Such a procedure is based upon an entirely wrong conception of the use of an arrester. As has been said already, it is almost impossible to protect a line from danger in the event of a direct stroke and the danger due to surges, which constitute fully 90 per cent. of the pressure rises to be dealt with even on overhead lines, is confined almost exclusively to the apparatus connected to the line. This being so the protective gaps should form part of the gear at main and sub-stations, and on no account should they be scattered promiscuously along the line. Further, they must never be connected direct to earth, but invariably through a resistance.

The action of the horn gap (fig. 12) is well known. The distance between the lower extremities of the horn is adjustable, and is set to spark across at say 50 per cent. above the working pressure. Owing to electromagnetic repulsion due to a current flowing across the gap (a circuit always tending to increase the area it encloses) the arc is driven up the gap between the horns until the ever-increasing length of the arc becomes too great for it to be maintained, and it breaks. The action is aided, though to a comparatively small extent, by the upward rush of heated air. The breaking of such an arc is gradual, the resistance progressively increasing till it breaks, and it has none of the instability and suddenness of break exhibited by the normal arc. In fact, it is doubtful if it is really correct to speak of it as an arc at all. Mr. Duddell has defined the arc as a circuit in which "the electrodes are being continuously volatilized, and the vapour of the electrodes takes part in the passage of the electric current." In the case of the horn gap, the volatilization of the metal is quite insignificant and the breaking of the circuit is devoid of all "quenching." In fact, when very low currents have to be broken and the electromagnetic repulsion is consequently small, a magnetic blow-out is sometimes fitted, but this will be found unnecessary, unless under exceptional circumstances.

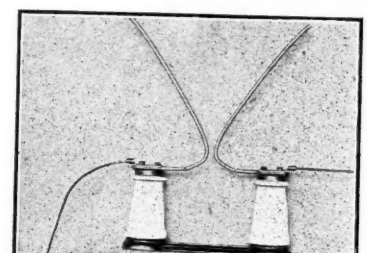


FIG. 12.

Owing to the suddenness with which it was at one time supposed that the horn gap arc was broken, it was suggested that pressure rises must be produced thereby. It may be said at once, however, that there is no ground whatever for such a suggestion. In fact, Schrottke (*E.T.Z.*, Vol. 31, p. 443) some time ago made most careful oscillographic tests with a view to settling this particular point. A 10,000 volt 50-cycle line was constructed and connected to earth through horn gap dischargers having series resistances of 1,800 and 600 ohms respectively, and again without any resistance at all. In no single case could a pressure rise be detected.

These and many other tests show conclusively that the horn discharger does not break the circuit with sufficient suddenness to produce a rise of pressure. In fact, the resistance shunted Wurts, the condenser shunted Giles, and the electrolytic arresters are each liable to break with much greater suddenness than the horn discharger. A further point which has sometimes been urged against the horn gap refers to the possibility of oscillations being set up by its acting as the spark gap of an oscillating circuit. The experiments of Schrottke (*E.T.Z.*, Vol. 31, p. 443) show conclusively that such oscillations do not occur, owing to the nature of the discharge which in no way corresponds to the ordinary oscillating spark gap.

With a view to obtaining greater accuracy of setting, so-called "relay" horn gaps have been used. In these arresters, which take various forms, the main gap is bridged by a comparatively high resistance having a small and accurately adjustable

platinum-tipped gap in series with it. This auxiliary gap is situated just below the main gap, and so soon as it discharges the air is ionised and the more widely set main gap discharges also. Such an arrangement only presents advantages for low pressures where the setting of the coarser gap is less easy and with the voltages at present in common use it has not been largely used.

In connection with the setting of all dischargers it is best to make the final adjustments on site, partly owing to the effect on the setting of small variations in construction or mounting, but still more because no two systems are the same as regards their requirements, and experience alone can determine the voltage at which the discharge would best occur.

(To be concluded.)

TRADE IN THE ARGENTINE REPUBLIC.

Writing on the subject of opportunities which will arise in the Argentine as a result of the withdrawal of German competition, the United States Consul at Rosario remarks that although stocks generally are large, business is impressionable, and, provided export trade recommences reasonably soon and crop prospects continue good, confidence should revive rapidly.

Up to the present Germany has had a strong hold on the market for electrical supplies. A good enquiry may be expected in the near future for articles such as globes, wire, fittings, etc., the market for which is more or less constant. The same holds true of dynamos and small motors, for which there is a good demand in the country, and supplies of which (nearly four-fifths from Germany) are said to be not very large. A slight increase may be expected in demand for electric fans, which already come, however, largely from Italy and the United States. The opening here is best illustrated by the fact that of the total imports of electrical appliances and supplies, valued at £1,796,000 in 1913, £1,032,000 came from Germany, £466,000 from the United Kingdom, and only £106,000 from the United States. The first demand in this important field will be for globes, cable, carbons, and small accessories. If the situation is favourable, the market for articles of this description should be excellent. Prices of common electric supplies have been raised from 10 to 20 per cent., and many firms, including German supply houses, are selling only against cash.

These hints by the American Consul for capturing German trade give point to the following excerpts from a German report on electrical matters in the Argentine which appeared just before the outbreak of hostilities.

The Argentine Electro-Technical Association, which was only founded last year, has, it says, done a good work in standardising conditions in respect to electrical installations and materials. These follow very closely the conditions of the Verband Deutscher Elektro-Techniker. Formerly numerous disputes and difficulties arose owing to the differing conditions under which various nationalities used to sell.

The two competing wireless telegraphy companies, the "Telefunken" (Siemens Schuckert) and the Marconi Company, made good progress last year. The former received a number of orders from the Argentine and Paraguayan Governments for inland wireless stations, whilst the Marconi Company derived considerable benefit from the Argentine law, which ordered wireless apparatus to be installed on all ships (including river steamers) frequenting its ports having fifty people on board. There is a special future before wireless telegraphy in the Argentine, because of the costliness and unreliability of other means of transmitting news, particularly in the thinly populated districts. At the same time, telegraph lines are being extended and improved, better results having been obtained both commercially and technically between the larger towns. Storms and floods, however, often cause serious interruption not merely on branch lines, but also on long main lines. The two large Buenos Aires telephone companies are enlarging their operations. The Union Telefonica, which has systems in and between Buenos Aires and other cities, has introduced the automatic telephone in Cordoba.

As to power plants, the existence of a few big groups, which provide various towns with electric power, does not mean that there is room for a lot of enterprises of this kind, but plants of from 150 to 200 kw. are becoming fairly numerous.

Electrical apparatus and instruments of all kinds are, of course, in continuously increasing demand. It has been suggested that standard switchboards should be kept in stock in Buenos Aires. One firm has already reaped advantage from having made a start in this direction. The installation of large reserve accumulator batteries is being discontinued, owing to the use of Diesel engines. Meanwhile, a local factory is doing good business with comparatively small batteries. There is a sale for batteries for lighting country houses in conjunction with naphtha motors.

In overhead construction, as well as underground circuits, methods have changed for the better, and a higher class of work is being put in.

The metallic filament lamp has completely ousted the carbon filament lamp and is partially replacing the arc lamp for street lighting. In this field, however, there is opportunity for profitable enterprise. Hitherto for street lighting the single differential arc lamp, with open arcs, has been principally used, of 8 and 10 to 12 amps. for direct-current and 12 to 15 amps. for alternating-current.

There are excellent opportunities of increasing sales of small pump motors, electric fans, cooking apparatus and domestic irons. The missionary work to be done lies less in the direction of introducing novelties of this nature than in the direction of overcoming a certain prejudice which has arisen through the placing on the market of an inferior quality of goods.

Already three Argentine ports are equipped electrically, viz., Buenos Aires, Rosario de Santa Fé, and Santa Fé. In view of the satisfactory results attained there, it is only a question of time before all important harbours will be similarly equipped. While on the subject of crane equipments, it may be noted that electric goods and passenger lifts are growing in favour throughout the Argentine. Of the latter there are estimated to be from 2,500 to 2,800 in Buenos Aires alone, mostly with double button-switch control.

MOTOR VEHICLES FOR ELECTRICAL WORK.

Motor vehicles have for some years been used as tower wagons in connection with the maintenance of the overhead conductors of electric tramways. As, however, automobiles are becoming more generally employed for industrial and commercial purposes, the scope of their use by electrical engineers is also steadily extending. Only the other week we alluded to their adoption by the British G.P.O. authorities as an auxiliary to their telegraph cable-testing department, while now comes some information with regard to other purposes for which petrol cars are being utilised by the electrical industry.

The first is in connection with the exchanges of the New York Telephone Co., which extend throughout New York, Brooklyn and the surrounding suburbs. This concern has in service a fleet of nine 12-15 cwt. motor lorries designed for use in carrying material and equipment needed for making the necessary connections between a modern telephone switchboard installation and the conduit manholes in the streets.

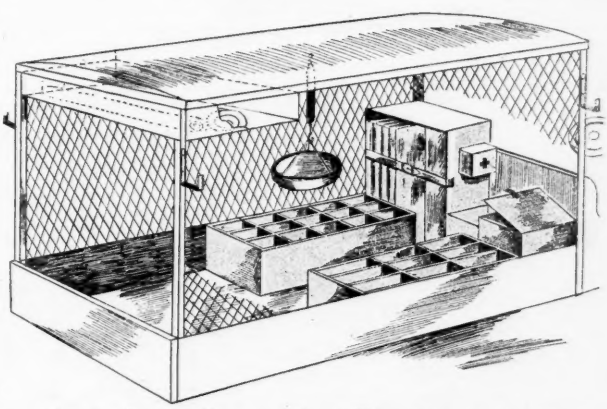


Fig. 1.—Special Body of Motor Vehicle used by the New York Telephone Co.

The vehicles are fitted with specially-designed bodies, the features of which are the low side boards and wire side screens. The length of the body is 8ft. 6in., the width 4 ft. 4 in., and the height 6 ft. 4 in. From the accompanying illustration, fig. 1, it will be seen that the interior of the body is provided with several boxes, each of which is intended to carry some material used in connection with telephone installation work. At the forward left is a tall, narrow box, open on the side facing the rear. Several long thin strips of paraffin, which, when melted, are used in waterproofing cable joints, are carried in this box and are held therein by means of a leather strap. Directly to the rear of this box is located a long, shallow box, divided into several compartments by means of wooden partitions, and intended for the storage of small pipe fittings, such as elbows and nipples in which wires are carried over fences. In the front of the body, on the right, are two square boxes, in one of which is carried the lead used in wiping cable joints, while the other accommodates miscellaneous tools and the petrol stove used in melting the lead. Directly to the rear of this box is another long shallow one, divided into several compartments in which are carried the fittings used in switchboard installations.

Under the roof of the body, at the rear end, is a shallow box open at its front side, in which rolls of fireproofed canvas, used in the wrapping of cable joints, are carried. A spring balance, with a suspended pan, intended for weighing the amount of lead used, is hung from the centre of the body top. For use in case of accident, a first-aid-to-the-injured kit, marked with a Geneva cross, is also provided, it being attached to the side of the box which holds the strips of paraffin. On the outside of each of the four roof posts is a U-shaped iron bracket used for the carrying of ladders, lengths of pipe, sump pumps, and coils of rope.

Another interesting use of motor vehicles, the machines being, in this case, of the electric type, is that of the New York Edison Co. in connection with the maintenance and repair of arc lamps in New York. The vehicles, which have a carrying capacity of from 15 to 20 cwt., are also fitted with bodies of special design, "A place for everything, and everything in its place," having apparently been the watchword of those responsible for its production. The body is of the panel type, and is of the following internal dimensions:—Length, 9 ft. 6 in.; width, 4 ft. 6 in.; and height, measured on the centre line, 6 ft. Wooden racks, 15 in. in depth, composed of compartments of different sizes, for the carrying of varying classes of material, are fitted on each side of the body, leaving an open passage-way 23 in. in width, in the centre. The racks on the left side differ from those on the right, the only particular in which they are similar being that their tops are the same distance below the roof of the body. The space between the cambered roof and the flat tops of the racks, which is approximately 8 in., is used for carrying coils of wire, miscellaneous tools and mechanics' overalls, the material being held from falling out by means of small doors hinged at their upper edges, three such doors being fitted on each side.

On the right side of the body, directly beneath the doors of the top compartments, are fitted two horizontal shelves for large exterior arc-light globes. Both shelves are divided into six compartments of sufficient size to accommodate one globe in each. The compartments are 15 in. wide and 15 in. in height, the total length of the shelves being 7 ft. 11 in., and the combined depth 32 in. The partitions forming the compartments are made of wood and the base and sides of each compartment are covered with a heavy felt mat to protect the globes from breakage while in transit. Removable bars, held in brackets at each end of the shelves, are fitted to prevent the globes falling out of the compartments.

The space between the bottom of the globe compartments and the floor of the body for a distance of 6 ft. 3 in. from the forward end is used for the storage of six complete arc lamps, suspended from hooks secured in the bottom of the lower globe shelf. The swaying of these lamps while in transit is prevented by means of a special iron bracket bolted to the side of the body. This bracket is made of one piece of flat iron bent into six semi-circular shapes, into each recess of which one arc lamp is fitted and secured by light ropes.

To the rear of the arc lamps, and directly beneath the globe compartments, are fitted, in two horizontal rows, four small drawers, 15 in. in width, 15 in. in depth, and 5 in. in height. Directly beneath these drawers, in which are carried miscellaneous pipe fittings, such as elbows, T's and nipples, are four open compartments for the accommodation of other miscellaneous supplies. Each of these compartments is sub-divided into two parts by means of shelves slanting backwards from the centre of the body.

On the left side a shelf, similar to that on the right, is located directly beneath the roof of the van. Below this shelf is another which is divided into two compartments for two of the globes, similar to those carried on the right, and a number of smaller compartments for small glass globes which are fitted inside the large exterior globes. The first two compartments are 15 in. in depth, width and height, while the smaller ones, though of the same depth and height, are only 4½ in. in width. Directly beneath the four small rear compartments are four others of the same dimensions and used for a similar purpose. The compartments are lined with felt and the globes are wrapped in tissue paper.

The space between the forward end of the body and the four lower rear compartments is utilised for six more arc lamps, of a larger size than those carried on the right; they are, however, carried in the same manner. A sheet-metal tool box is located at the rear end of the body beneath the four small lower globe compartments. A small box, open at one end, is also fitted at the rear side of these compartments, as indicated in fig. 2, it being intended for carrying a small quantity of arc-lamp carbons. Two 12-foot step-ladders and one 20-foot extension ladder, carried on U-brackets fitted on the front and rear roof posts of the body, complete the equipment carried. When completely loaded, the van has a carrying capacity of six of the large and six of the small type arc lamps, fourteen of the large exterior arc lamp globes, and sixty-four of the small interior globes. Besides this, quantities of arc-lamp carbons, bolts, screws and miscellaneous fittings are carried in the small compartments.

We are indebted to *The Commercial Vehicle* for the illustrations.

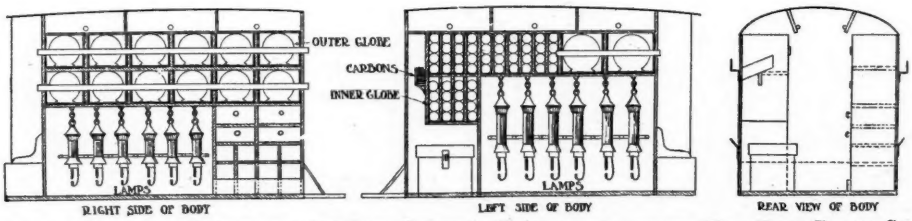


Fig. 2.—Details of Interior of Arc Lamp Renewal Vehicle used by the New York Edison Co.

ELECTRICAL APPLICATIONS FOR PARLIAMENT TO CONSIDER.

The following is a list of the applications for electric lighting, power and traction powers that have been filed for consideration by Parliament and the Board of Trade next session. The list is, as might be expected, much shorter than usual:—

(*a*) **Electric Light and Power.**

Altrincham.—Application by Altrincham Electric Supply, Ltd., for alteration of 1893, 1896 and 1912 orders. Transfer to Altrincham and District Electric Supply, Co., Ltd., 123, Queen Victoria Street, E.C.

Andover.—Crompton & Co., Ltd., application for E.L. prov. order.

Ascot.—Ascot and District Gas and Electricity Co. Various powers, including power to take supply of energy in bulk.

Boston.—Application by R. A. Smith for E.L. order for Boston and district.

Chipstead and District.—Application by G. Allom for E.L. prov. order for Chipstead, Reigate R. D., and several parishes.

Connah's Quay.—U.D.C. E.L. prov. order.

Dearne District.—U.D.C.'s of Wath-upon-Dearne, Bolton-upon-Dearne, and Thurnscoe, for a joint board for joint exercise of E.L. powers.

East Grinstead.—U.D.C., application for E.L. prov. order.

Ely.—Ely Gas and Electricity Co., Ltd., application for E.L. prov. order.

Harrogate.—Corporation, extension of area of supply to include Knaresborough U.D. and certain parishes.

Haworth.—U.D.C., application for E.L. prov. order.

Irlam.—U.D.C., E.L. prov. order.

Keighley.—Corporation, extension of E.L. area, to include urban districts of Oxenhope, Haworth and Oakworth.

Kingston-upon-Hull.—Corporation, elec. supply in Hessle U.D.

Knaresborough.—U.D.C., E.L. prov. order.

Litherland.—U.D.C., E.L. prov. order.

London.—L.C.C., establishment of Electricity Authority for London and adjoining districts; taking over undertakings and powers, and many incidental provisions.

London.—London Electric Supply (No. 1), new company to exercise any powers with regard to elec. supply in or near London that may be conferred upon the L.C.C. or any other public authority.

London.—London Elec. Supply (No. 2), new company to supply energy for all purposes in administrative County of London and parts of Middlesex, Hertford, Buckingham, Berks., Surrey, Essex, and Kent; take over existing companies, etc.

Mid-Somerset.—Application for prov. order by Christy Bros. & Co., Ltd., to supply Street U.D.; Glastonbury borough; City of Wells; and parts of rural districts of Wells and Langport.

Normanton.—U.D.C., E.L. prov. order.

Ormskirk.—Ormskirk Gas Light Co., elec. supply in Aughton; generating station, etc.

Plymouth.—Corporation, various powers relating to the electricity and tramways undertakings.

Reading.—R.E.S. Co., Ltd., extension of area to include Henley-upon-Thames, and parts of Henley and Wokingham.

Ryde (I. of W.).—U.D.C., provisions for transfer of 1899 E.L. powers to I. of W. E.L. & P. Co., Ltd.

Selby.—Electrical Distribution of Yorkshire, Ltd., E.L. prov. order.
Skipton.—U.D.C., application for E.L. prov. order.
Southampton.—Corporation, extension of supply area to include Bitterne and South Stoneham, etc.
Stanley.—Electrical Distribution of Yorkshire, Ltd., E.L. prov. order.
Teignmouth.—Messrs. J. & W. Purves, E.L. prov. order.
Tenby.—Corporation, E.L. prov. order.
Tunbridge Wells.—Corporation, extension of supply area, to include Southborough and parts of Tonbridge, Sevenoaks and Ticehurst.
Yorkshire Electric Power Co., Ltd.—Sub-division of shares; removal of restrictions as to supply for lighting; lighting supply in certain districts; and other powers.
Warrington.—Corporation, extension E.L. powers, to include parts of Runcorn and Warrington.
Woodford and District.—County of London E.S. Co., Ltd., elec. supply powers for Buckhurst Hill, Chingford, Loughton, Wanstead and Woodford, and Chigwell.
Ystradgynlais.—R.D. Council, E.L. prov. order; purchase of undertaking of Glantawe E.S. Co., Ltd.

(*b*) **Electric Tramway and Railless Trolley Vehicles.**

Aberdare.—U.D.C., new tramways, tramroads, and railless traction, bulk elec. supply powers.
Bristol.—Bristol Tramways & Carriage Co. Ltd., extension of time for exercise of certain powers.
Bury.—Corporation, additional tramways.
Dewsbury.—Corporation, new tramways; running powers over other systems; motor omnibuses; further elec. supply powers.
Halifax.—Corporation, new tramways in Halifax, Brighouse, and a number of urban districts; powers to carry minerals and goods on all Corporation tramways, trailer cars, trolley vehicles, etc.
Hull.—Corporation, further tramway powers.
Lincoln.—Corporation, further tramway provisions, extension of generating station, running electric trolley vehicles, etc.
London.—L.C.C., new tramways and tramway reconstructions; power to run coupled and trailer cars north of the Thames; various incidental provisions.
Rhondda.—U.D.C., additional tramways in Clydach Vale and Blaenrhondda.
Rotherham.—Corporation, new tramways; motor omnibuses; amendment of provisions as to contribution toward maintenance of roads traversed by trolley vehicles; electricity provisions.
Sheffield.—Corporation, new tramways, compulsory purchase of and running powers over Rotherham Corporation tramways in Sheffield; motor 'buses.
South Shields.—Corporation, new tramways; motor omnibuses; also certain provisions relating to electricity supply undertaking.
Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.—Additional tramways in West Riding, and in Chester and Derby counties; extension of elec. supply area; purchase of Glossop elec. supply undertaking from the Urban E.S. Co.; and other powers.

(*c*) **Railways.**

Metropolitan District Railway Co.—Various general, extension of time, widening, and other powers; also agreements with railway companies for laying cables from Lot's Road to Central London Railway, and supply of energy to other railways.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

U.S.A. Safety Rules.

We have read with much profit your comment, in the October 30th issue, on the safety rules for operation of electrical equipment and lines, published in Circular No. 49 of the National Bureau of Standards.

Your conclusions as to the considerations which led to the issuance of operating safety rules before the construction rules, are generally correct, and we fully realise the many features of construction and installation in this country in which the life hazard has been less guarded than have fire hazard, continuity of service, or initial costs. The reason for the development of such construction is, no doubt, to be found in the fact that such electrical standards as are now effective in this country have been developed by fire protection and operating interests, with little or no assistance or restraint by Governmental or similar influences directly representing the public safety.

In your own country, construction from an early date received the constant attention and guidance of the public authorities, and, to the extent that inspection has secured compliance with your regulations, accident-prevention requirements have been incorporated no less than those for fire hazards. In this country the application of uniform standards by uniform inspection methods has been largely confined to interior wiring installations, and, in them, to surveys from the fire-hazard standpoint. We are forced to realise difficulties introduced in the preparation of construction and installation rules by the great development which has taken place to some extent unrestricted.

Your further comments are awaited with much interest, as representing the point of view of engineers familiar with the working, over long periods, of comparatively rigid accident-prevention requirements. Appreciating your careful consideration of this subject and the Bureau Circular, we are—

S. W. Stratton, *Director.*

Department of Commerce,
Bureau of Standards, Washington,
November 16th, 1914.

Street Lighting in Chicago.

In your issue of October 30th, 1914, page 607, appears a communication under the title of "Street Lighting in Chicago." Your correspondent criticises as "most misleading" an account extracted from the *Electrical Review and Western Electrician*, in your issue of October 9th. It is apparent that he is not informed with regard to the recent developments in incandescent lamps. Mazda lamps corresponding to the 600-C.P. size, as used in Chicago and as made by the leading manufacturers in the United States, *do* give an actual efficiency measured by 2 mean horizontal C.P. per watt consumed, with a rated burning life of 1,350 hours.

These lamps are now being adopted rapidly by the leading cities in this country, in competition with arc lamps.

While I am not as familiar with the recent progress in flame arc lamps as I am with the incandescent, I am aware that both European and American-made electrodes have been used here. I have every reason to believe that the results obtained have not been far different from those obtained in Europe, except that our practice has tended toward the enclosed flame arc, on account of its superior operating characteristics and maintenance cost, which under our conditions more than compensate for the difference in efficiency. The only arc lamp which we now recognise as competing with the Mazda, for street lighting, is the Magnetite or luminous arc.

While it is true that the flaming arc is more efficient as measured arbitrarily in initial C.P. per watt, operating comparisons in Chicago and elsewhere show that both the Mazda and Magnetite arc will, under average conditions, deliver more useful illumination in the street, per dollar of cost, than does the flaming arc. It was on this basis that the Mazda lamp was selected in Chicago, allowance being made in figuring the operating cost for current, labour and materials of maintenance, and interest and depreciation on the investment.

Candle-power is a much abused term, and comparisons based on such values, unless qualified or interpreted, are the most frequent source of misleading conclusions in street lighting practice. Candle-power efficiency comparisons, properly made, are of considerable value, still they do not form a complete basis for the selection of units for lighting service, and the other items, such as character of distribution, cost, &c., are frequently of sufficient value to give reversed results.

G. H. Stickney,
Assistant to Sales Manager, Edison Lamp Works.
Harrison, N.J., *November 19th*, 1914.

Workhouse Supply.

I have been particularly interested in the report *re* Willesden Workhouse supply. As I am not acquainted with the details of the conditions existing at the workhouse, the remarks by the District Council's engineer certainly tend to strengthen my opinion regarding the operation of Institution engineering arrangements. I have made quite a deep study of this particular branch of work for some years now, and have been very keen in observing plant in use at institutions, &c., as to their various merits in dealing economically with the various loads one finds in such places. Personally, I feel confident that it is possible to arrange the load and plant in such a manner that it is a very difficult matter commercially for a public supply of electricity to step in and displace your own arrangements for generating. To supply engineers this may be a rather difficult point to appreciate, but anyone who has dealt with such problems must admit that when you have steam boilers and plant in use, not necessarily for electric lighting and power, but compulsorily for other purposes, it opens a great field for thought, and a vast deal could be written on the subject. He would be an excellent engineer who could furnish a complete report, as to how the various costs for the different sources of steam, light and power in an institution should be set out. Of course I mean for, say, a period of one year, as it is quite possible for a number of hours, and perhaps days, but when exhaust steam is utilised for heating buildings, it is almost impossible to obtain reliable figures over a long period. It does not follow that such combinations are not economical and efficient, and, further, it is a fact that if you do not take the fullest advantage of your necessary power and steam plant, the purchase of electrical energy to displace your own steam plant increases the cost of dealing with the other necessary load, which has to be dealt with, as most of the factors that make up the cost for lighting and power in

institution work cannot be dispensed with. If a supply company could step in and sweep out all the boiler and steam plant and dispense with most of the staff, that would be another matter, and I think if all the conditions and costs, &c., were known about the institution in question, especially when the District Council's engineer mentions that it would have been necessary to install a battery of such dimensions as to warrant a cost of £150 annually with only an annual load of 44,701 units to be dealt with, it would assist in arriving at more definite calculations.

It is, and always must be, a difficult problem for a Board of Guardians, for instance, to discuss thoroughly the different methods proposed to them regarding their engineering arrangements, and it is unfortunate that more reliable information is not published from time to time regarding institution arrangements. I have no doubt it would astonish many engineers to hear of the amount of plant involved in institution work, and the total cost of fuel for various purposes, and the numbers of different types and systems for heating purposes that are advocated, and used in almost every institution. The purchase of electrical energy from an outside source would completely take away, in almost every case, the commercial efficiency of the plant working as a whole combination. In conclusion, I think that the information furnished by Mr. Blake certainly makes the cost against the Guardians very misleading, especially to engineers who are not acquainted with the varied and difficult problems to be dealt with in institution work.

An Institution Engineer.

Why Great Britain Loses Trade.

It occurred to me that it might be of some interest to your subscribers to know one of the reasons why there is not more British electrical machinery in Canada than there is, and I would state, for the information of manufacturers, that a good deal of the trouble is due to improper installation. The conditions of construction or installation and operation of plant in Canada are very different to what they are in the Old Country. For instance, in the Old Country it is usual to get the engineer who will ultimately take charge of the operating of the plant to supervise the construction also. In this country this is not the case, as it is seldom that trained engineers are actually in charge of the operation of plants. These men are drawn from a class who have often started as floormen or oilers, and have actually worked their way up to taking charge of the station in which they have had all their training, and are able to hold their jobs through a knowledge of that particular job only. These men are termed "operators," and in many cases are only capable of starting or stopping a plant and keeping it oiled, &c, and are not able to locate other than very obvious troubles. I have come personally across two or three cases in Canada where plant supplied by British firms has given serious trouble, due to manufacturers not realising the above conditions, and I am sure that if manufacturers would instruct their offices in Canada not only to see that the plant was supplied as per specification, but to see also that it was started and operated for two or three months, a great many of the unpleasant experiences which they are subject to would disappear. I could, of course, give specific instances where lack of attention has given British material a very bad name, and where the trouble has been caused by so-called "Operators" not understanding the material which they were operating. It is, therefore, very apparent that the manufacturers must see that everything is correct before passing it out of their hands.

Canada.

Montreal, *November 25th*, 1914.

[Our correspondent states that there are many cases in Canada which the above conditions fit exactly, and he will be glad to give further details in response to personal inquiries which may be made through ourselves.—Eds. Elec. Rev.]

There has been a great deal of rather windy talk about capturing German trade, but we poor exiles in the Colonies would be only too glad if the firms at home would only treat us decently as regards the goods we do order from Great Britain. Packing is bad, no instructions are sent with complicated machinery, articles are sent incomplete, and suggestions for improvements are treated in the most off-hand manner. In connection with the above I give typical cases I have myself seen if not suffered from :—

1. Two large flat iron dials were sent out packed in straw, instead of being placed on strips fastened to the sides of a tin-lined case, so that the dials would neither touch each other nor the case. As it was, the painting was ruined and the graduations and figures were quite illegible. They had to be painted again, but will never look the same. The customer was just bled of so much money through the supplier's carelessness.

2. A petrol engine was supplied (through an agent) with the piece of machinery it was to work. The engine and piece of machinery were of a new pattern, but no drawing or instructions were sent. Connection pipes were not supplied, nor a water tank for cooling water, nor was there any note of what size of tank would be necessary. This engine had been sent to an engineer in the jungle, whose curses were deep, and who, if it had been in his power, would have seen that no more orders went to that firm.

3. I was supplied with a machine which worked well, but developed several defects in use. I went into the matter very carefully and made practical suggestions which could have been carried out at little, if any, extra cost. Those suggestions were sent on to the manufacturers, who airily replied that the machine was their standard make, they had had no complaints, and they did not propose to adopt the suggestions. So here was a firm who, for nothing, had been offered suggestions from a practical engineer who knew his own difficulties, the class of labour available, and the difficulties which arose from climate; but no, their smart designing staff, who probably had never been outside the walls of the factory, knew better. I am now using the machines of another firm.

4. From my long experience of British firms' export supplies I feel certain that utter slackness is the badge of all the tribe. It is all very well to be patriotic, but when one compares the treatment we receive from British manufacturers and their agents with the courtesy and eagerness to meet our views which we receive from Continental firms, is it any wonder business is lost?

A Sufferer.

India, *November 13th*, 1914.

"The Mechanical Design and Construction of Generators."

My attention has been called to a review in your columns of my recently published book in the *Electrician* series with the above title. The tone of this review appears to me to be unduly bitter, but I cannot, of course, discuss this point.

To some of the errors to which your Reviewer refers I must plead guilty, but in nearly every case he has discussed the error from an inaccurate standpoint. Any reader of the Electrical Review conversant with the subject will realise this peculiar feature of the Reviewer's attack. I will give a few instances to prove my case.

The first error your Reviewer refers to (on my page 29) he considers is in the integration, and that the final results should be $A^2t\ \pi/4$, and he tells us that if this is the case all the following results would be wrong. I would point out, however, that if his result is correct, then the inertia for bending would be equal to the inertia for torsion, which is, of course, absurd. The error is neither in the integration nor in the final equations, but, as is quite obvious, is a misprint in the first expression, and this alters the whole complexion of the error, as no subsequent work is affected. Further, it is an obvious error to any one with some knowledge of the subject.

As to your Reviewer's use of a 10-in. slide rule, I envy his expertness, but I decline to believe that the curve he would obtain from this expertness, in the case mentioned, would have any regular shape.

With regard to his remark upon the formula for binding wire, which he says is given on p. 144, but which I find is on p. 145, I cannot understand the Reviewer's difficulty.

With regard to press fits, I have seen no thick cylinder formula which gave satisfactory results in practice.

I cannot find any misprint on p. 36 or p. 134.

My chapter on pulleys and gearing gives methods of proportioning which I have not seen in any pocket book; they are to a large extent entirely new.

As to stator frames, the text-books usually leave the investigation in such a condition that it is difficult for an engineer to make use of it for the alternator frame. Indeed, several formulæ published in technical papers for alternator frames are quite wrong.

On the whole, the review strikes me as in the nature of an attack, and it may perhaps be worth while pointing out some of the errors which the Reviewer himself has fallen into. I cannot, however, conceive anyone else falling into them.

R. Livingstone.

Preston, *November 30th*, 1914.

The Reviewer wishes to say at once that his criticism of the book, "The Mechanical Design and Construction of Generators," was not intended to be an attack—or to be very bitter. The Reviewer had never seen Mr. Livingstone, or even heard of him until the work under discussion was sent him.

The author admits that "some" of the errors pointed out in the review do occur, but thinks that the accuracy of his results is not affected. While agreeing that in these said cases he may have obtained correct results by wrong analysis, it only leads one to suppose either that the book was carelessly written, or that the proofs were corrected in a slovenly manner.

The Reviewer is surprised to hear that the author has not seen any satisfactory formulæ based on thick cylinder methods for press fits. At the same time, there are such formulæ, and, moreover, they are in use at two large electrical works to the Reviewer's personal knowledge, and, doubtless, also at other places where press fits are used. They are based on Lamé's thick cylinder hypothesis, and throw a good deal of light on the problems connected with force fits generally. As far as the Reviewer is aware, this particular case of Lamé's general equations is not published, but probably the author will be able to work it out for himself. As pointed out in the review, the best guide for this work (or any other, for that matter) is practical experience, but such things as the stress in the rotor hub, and the probable coefficient of friction between the hub and the shaft, cannot be predetermined without analysis, and the thick-cylinder method is far superior to the one put forward by the author.

The author states that he cannot find any misprints on page 36 or page 134. All the Reviewer can say then is that the author adopts a novel way of spelling "satisfactory" on page 36, line 17.

He spells it "staisfactory." On page 134, line 10, he calls "inertia" what probably most technical men would call "moment of inertia." Of course, the Reviewer knows these are unimportant, and they were not specifically mentioned in the review, but the author deliberately says that he cannot find the misprints, after his attention has been directed to the pages.

Regarding pulleys and gearing: Naturally the author thinks his methods of dealing with these details are largely novel. However, the Reviewer is still of the opinion that quite as good results might be obtained from pocket-books—as they have been in the past, and possibly will be in the future.

Regarding stator frames: The Reviewer is not concerned with wrong formulæ that have been published in technical papers. As a matter of opinion, the Reviewer thinks this part of the book out of proportion altogether in regard to the rest of the work.

The Reviewer, after careful consideration, really cannot see that he can do better than repeat the last paragraph of the review:—"The general impression of the book on the Reviewer is that it contains a good deal of information, but, at the same time, he would strongly recommend any buyer to check the mathematical expressions before he uses them. The price also seems excessive."

The Reviewer.

Trading with the Enemy.

In your issue of last week you quoted a letter of mine to the *Financial Times* on the "Trading with the Enemy, 1914, Amendment Bill."

Since the time of writing, the Bill has become law, but, unfortunately, although an amendment was put forward to embody a clause which should empower the Secretary of State or the Board of Trade to determine or suspend any contract made between British subjects and an enemy alien, through lack of active support the amendment was withdrawn. The withdrawal, however, was not on the score of actual opposition as such, but due practically—as the Attorney-General put it—to the difficulty of getting an adequate commercial expression which would cover all the exceedingly complex cases which would have to be dealt with under such provision.

The Act, of course, had a very hurried passage through the House, as it had to be got over in practically two or three days, so that one can sympathise to a certain extent with the Attorney-General in not wishing to include any amendment on this score of contracts, unless it was in such a fashion to reach finality.

Now, however, when there is plenty of time properly to formulate a measure to meet the case, it is important that some steps should be taken by commercial men to come to unanimity as to what it is necessary to embody, and then to make representations to the Attorney-General with a view to the introduction of a further Amendment Act.

That the Attorney-General is prepared to receive such representations is most clearly put forward in his speech; when the contract amendment was being dropped, he said:—"If I gather, as a result of consultation with hon. members in this House, and citizens outside, that it is really desirable to make a trial, I will endeavour to get the help of a limited number of those who would be able to help." He goes on to say that these would include one or two members, and one or two of commercial experience, and, possibly, some of judicial experience.

What is particularly necessary is that there should be unanimity of opinion among commercial men. As the Attorney-General said, proceeding further:—"It is no good unless you are in a position to say what you want definitely, both for yourself and everybody else."

It is to be hoped, therefore, that something will be done on these lines as soon as possible, as there are contracts involving altogether a huge amount of money, which are being held up pending definite legislation. Directly such is forthcoming these contracts can be transferred to British firms; incidentally, also, this would mean the immediate employment of a considerable amount of labour.

That there is nothing to be gained by leaving the whole matter in its present state of uncertainty must be patent to every commercial man.

T. W. Cole.

London, E.C., *December 8th*, 1914.

Signalling Supplies Wanted.

The Commanding Officer of a Signal Company, R.E., attached to the new Expeditionary Force, wants to borrow the following articles:—

1. Small lathe with slide rest and tools. Not necessary for it to have screw-cutting gear, although it would be helpful.
2. Bench vice, about 12-lb. weight.
3. Tools of all kinds, carpenters' or other trades (a list is difficult to compile, but would be furnished).
4. Soldering gear, both large and small bolts.
5. Brazing lamp.
6. "Quantity and intensity" detectors (two).
7. Duplex telegraph galvanometers (two).
8. Telephone receivers with cords (a couple of dozen required).
9. Microphones (half a dozen).
10. Portable telephone sets complete (half a dozen).
11. Insulated wire on drums suitable for laying out of doors. Must be flexible and not easily broken (some miles).

Any cash subscription will be welcome, and an account can be rendered, if desired, for expenditure on ebonite, brass, German silver wire, or copper scraps, which might "make up" into something. Platinum suitable for electric contacts. Assorted nails, screws (brass especially), electric terminals. Insulating copper wire of all sizes, from fine 40 B.W.G. for winding bobbins, up to heavy rubber-covered for exposed places. Bell wire can be bought locally.

It is impossible to obtain them in the usual way through the Government supplies, and there are no doubt many of your readers who are in a position to assist a very gallant arm of the service in this manner.

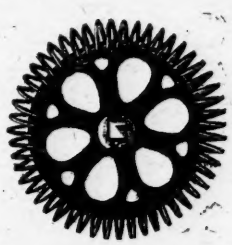
I shall be glad to receive any offers in writing at this address, but I cannot undertake to receive any of the goods. I will place any suitable offers before the Commanding Officer above mentioned.

R. Macleod,
Secretary, National Service League.

London, S.W., *December 8th*, 1914.

Handles for Electric Ovens.

May I suggest that manufacturers of electric cooking ovens should adopt a standard form of handle which would always be easy and cool to grip. A simple and cheap form is a wire valve



wheel as shown on the enclosed illustration which is always cool even when used on valves passing steam at the highest possible temperature.

W. H. Allen, *Engineer and Manager.*

Corporation Electricity Department,
Loughborough, *December 2nd*, 1914.

[The device illustrated is the "Cosmopolitan" handle of Messrs. Holden & Brooke, Ltd.—EDS. ELEC. REV.]

LEGAL.

THE OSRAM LAMP WORKS, LTD., *v* THE CORONA LAMP WORKS, LTD.

THE defendants' application to postpone the trial of this patent action on the ground that the German experts they had retained to give evidence for the defence were no longer available, and that supplies of tungsten acid required for any further experiments were unobtainable owing to the war, was renewed before Mr. Justice Sargant in the Chancery Division on Thursday, December 3rd.

Before the application was proceeded with MR. WALTER, K.C., for the plaintiffs, said he desired to make an offer, and, if it was not accepted, he should ask for an adjournment to cross-examine the defendants' witnesses on their affidavits. The case had been pending since July 3rd. On October 16th, his Lordship gave the defendants an adjournment of six weeks, and he now offered them another six weeks.

MR. ROMER, K.C., for the defendants, said the plaintiffs had taken two years to get ready.

MR. WALTER said, as his offer was not accepted, he would ask that the application for an adjournment should stand over to cross-examine two of the defendants' deponents.

His LORDSHIP said he had never before heard of an application to cross-examine witnesses on an application for postponement of a trial, but the circumstances were exceptional, and there was nothing in the rules against cross-examination.

MR. ROMER did not object, and his LORDSHIP said he would take the cross-examination before him in Court on Monday, December 14th.

ARBROATH ELECTRIC LIGHT CO.'S VALUATION APPEAL.

THE Lands Valuation Appeal Court, at Edinburgh, on Decem-4th, considered an appeal by the Arbroath Electric Light and Power Co., Ltd., who complained of an entry of £1,215 in the valuation roll in respect of their works and mains, claiming that £500 should be the entry in the roll. By a majority the Valuation Committee fixed the valuation at £1,100. The appellants contended that the method of valuation adopted by the assessor in taking only one year's accounts was not in accordance with the proper application of the revenue basis; that an average of at least three years' accounts should be taken; and that prior to this

year the Assessor based his valuation on an average of three years' accounts, and 1913 was an abnormally good year for the company. The Assessor held that in 1913 additions were made to the plant and machinery to the amount of nearly £8,000, increasing the value of the subjects by a third, and accordingly the profits earned in 1911 and 1912 did not reflect the earning capacity of the undertaking in its present state, while the profits of 1913 did more nearly represent that earning capacity. After hearing counsel, their Lordships made avizandum.—*Edinburgh Evening Dispatch.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Main Regulators.

We recently described in these columns the rectangular type of main regulator with strip resistance, manufactured by the General Electric Co., of Witton; the accompanying illustrations show a quite different pattern. The regulator, fig. 1, is of the G.E.C. standard construction, and will control a 5,000-kw. turbo-alternator; this pattern of regulator has been supplied by the G.E.C. to an important municipality. It consists of a circular face-plate regulator of extremely strong construction, mounted on the same angle-iron frameworks as, and connected to, a G.E.C. cast alloy grid resistance. It will be seen from fig. 2 that the connections between the contacts of the regulator and the resistance are of solid copper bar, to enable a thoroughly good connection to be made; the regulator contacts are turned round at right angles, and the copper rods are screwed to them; therefore there are no loose wires to be found anywhere in the regulator, the whole of the contacts being solid throughout.

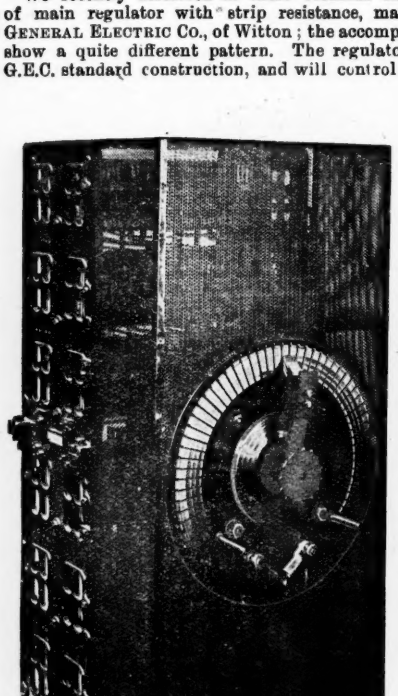


Fig. 1.—G.E.C. Main Regulator for 5,000-kw. "Witton" Turbo-Alternator.

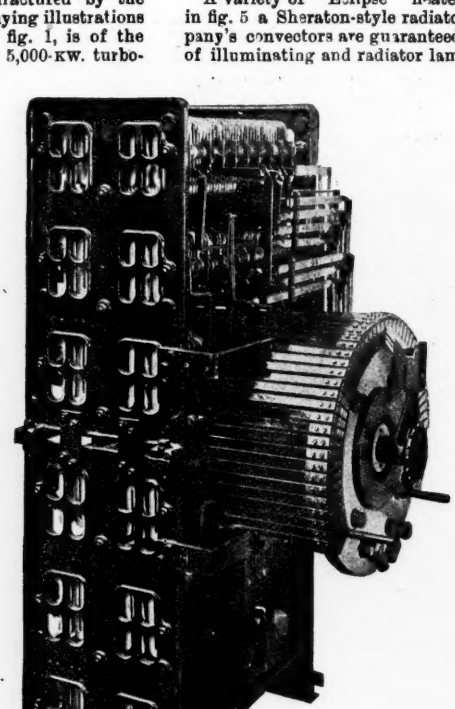


Fig. 2.—Interior View of Main Regulator, showing Solid Connections.

The "Underwood" Digger.

Mr. A. L. Underwood, of 3-5, Queen Street, E.C., has sent us particulars of his new digger or grab, for which special advantages are claimed, including lightness, simplicity and ease of control. It is suitable for handling coal.

"Eclipse" Heating and Cooking Apparatus.

The Electric and Ordnance Accessories Co., Ltd., of Chester Road, Aston, Birmingham, send us particulars of a number of domestic heating and cooking devices which, they point out, form seasonable gifts at the present time. Amongst these are the toaster and combined toaster and grill, either of which is suitable for table use, the latter—shown in fig. 3—being suitable for grilling chops, bacon, &c., and keeping plates, dishes and liquids warm, as well as toasting. This apparatus is recommended especially for small households on account of its great convenience.

We also illustrate in fig. 4 an "Eclipse" kettle, one of numerous designs, in polished copper, pure-tinned inside; the company also supply breakfast cookers, fry-pans, jugs, urns, &c., in addition to the above.

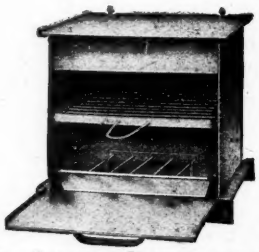


Fig. 3.—Combined Toaster and Grill.

A variety of "Eclipse" heaters are available, and we illustrate in fig. 5 a Sheraton-style radiator of attractive design. The company's convectors are guaranteed for five years, with the exception of illuminating and radiator lamps.

Fig. 4.—Eclipse Kettle.

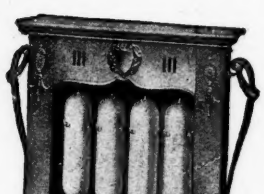


Fig. 5.—Sheraton Style Radiator.

We may also draw attention to the "Eclipse" irons, which form a welcome addition to the average household equipment, and can be supplied in various patterns.

OUR LEGAL QUERY COLUMN.

"Push" writes:—"I shall be extremely obliged if your legal contributor will answer, through the medium of your valuable paper, the following question, which is at the present of vital importance to the electrical supply industry. Without a Corporation possessing special powers, are they within their legal rights in supplying energy to their consumers at the power rate for cinematograph or photograph developing, &c., or can it be argued that they are giving one particular trade a preferential tariff, seeing that they are using the energy supplied for lighting purposes, although it is not for general illumination?"

*** The question is a nice one. It may be argued, with some show of reason, that electricity used in a cinematograph lantern is not being used for general illumination. One might even go further and say that some of it is being used, in a sense, for power, inasmuch as the moving parts of the lantern are driven by electricity. Having regard to the express provisions of Sec. 19 of the Electric Lighting Act, 1882, it does not appear to be possible for anyone obtaining current for the ordinary purposes of illumination to raise any objection to the charge made at a

cinematograph theatre. That section provides that: "Where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the licence, order or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply."

Having regard to these terms, it is reasonably plain that no ordinary consumer on the one hand, and no power consumer on the other, could object to the terms on which energy was supplied to a cinematograph theatre.

WAR ITEMS.

Electricity Supply Employés and the War.—It will be remembered that the question of allowances to be made to electric supply employés taking the place of those who have gone to the front, if they themselves should elect to go shortly after entering upon their engagements, was raised at West Ham. The matter has now come forward at Fulham. A man was temporarily engaged in August to take the place of a regular employé who had enlisted. In November the said temporary employé himself enlisted, and an application for allowance to be made to his mother during his absence had to be considered. As a result the Electricity Committee now recommends the Council to pass the following resolutions:—

(a) That the resolution passed by the Council on the 9th September, 1914, with reference to leave of absence and payment of officers and servants away on naval or military service, be limited in its application to the permanent staff, and that it be an instruction to the chief officers that no man eligible for naval or military service be employed to fill temporary vacancies caused by employés joining the forces.

(b) That, as from the date of this meeting, the aforesaid resolution of the Council of the 9th September, 1914, be deemed to apply only to such officers and servants who enlist for active service abroad.

The Associated Municipal Electrical Engineers (Greater London) has forwarded to the Committee the following copy of an important letter received from Major-General Sir Francis Lloyd, K.C.B., commanding the London District, on the subject of recruits, viz.:—"Headquarters, London District, Horse Guards, S.W. 25th November, 1914. Sir,—I am informed that many employés of the various Electrical Associations in the London Command have already joined His Majesty's Forces, and are serving their country both at home and abroad. It has now come to my knowledge that many other men employed in the electrical services of the Metropolis are also desirous of joining the forces in the field, and that there is considerable risk of the necessary staffs being thereby so depleted that the power stations and electricity centres will be insufficiently manned. I need hardly say that the result of expert employés leaving their occupation in such a manner would entail great inconvenience to the civil population of this city, and might very easily have disastrous consequences on the conduct of the war. Under these circumstances I desire to express to you my undoubted opinion that the ordinary public services of the Metropolis are at the present time of the first importance, and that the trained men who maintain their efficiency are serving their King and Country in a proper manner and as usefully as if they were fighting in the field, and further, that to disorganise the electric and power services of London by enlisting at the present moment would be a serious dereliction of their duty to the State. I should be glad if you would give the fullest publicity to this letter.—(Signed) Francis Lloyd, Major-General Commanding London District." The Electricity Committee report that they have considered this matter, and whilst they are in accord with the views expressed by Sir Francis Lloyd, are of opinion that the men who are eligible and willing to serve should at least be granted some certificate that they have offered, and they suggest that representations be made on these lines to the Military Authorities. They accordingly recommend:—

That representations be made to Major General Sir Francis Lloyd urging the desirability of a certificate being issued to the men employed in the various electric lighting stations in the Metropolis, who are eligible for and desirous of joining either the naval or military forces for active service abroad, that they are engaged on equally important duty by remaining at their post during the present crisis, and further indicating that it was through no fault of their own that they did not actually join the forces in the field.

Hart Accumulator Men with the Forces.—We have received the following letter:—"Your readers may be interested to know that 87 employés of the Hart Accumulator Co., Ltd., of Stratford, London, are serving in H.M. Forces, both at home and abroad. The percentage of men having left the works and offices on this account is between 25 and 33. Shortly after the outbreak of war the employés, by means of voluntary weekly contributions, initiated a scheme of relief for the dependents of their fellow workmen who had enlisted, and with the co-operation of the company and its directors, the committee has already been able to grant relief of over £250 to the most necessitous cases. Two of our number we shall unfortunately see no more, whilst a few have been wounded in action, but we hope to welcome the remainder back to East London safe and sound at no distant date.—A. F. J. Davis, Secretary (pro. tem.) to the Relief Fund. December 4th, 1914."

German Capital in the Russian Electro-Technical Industry.—H.M. Consul-General at Moscow (Mr. C. Clive Bayley) has furnished the following particulars, taken from the "Vyestnik Finansov" (Petrograd of 28th September/11th October, regarding the investment of German capital in the electro-technical industry of Russia:—"During the last twenty years the German electro-technical industry has won for itself a special position in foreign countries. The various electro-technical groups in Germany are so closely connected that they may practically be considered as one large combine, and the triumph of German capital has been so complete that the various foreign markets have had to accept the conditions dictated by the leaders of this powerful trust. As regards Russia, the German electrical firms have established what is practically a monopoly, as hardly any large electrical installation in Russia has been carried out without their help. The total capital invested in the various Russo-German electrical companies is shown in the following table:—

	Year of Foundation.	Ground Capital. Roubles.
Allgemeine Elektrische Gesellschaft	1910	12,000,000
Allgemeine Elektrische Gesellschaft	1901	12,000,000
Siemens and Halske	1898	5,600,000
Siemens—Schuckert	1913	15,000,000
United Cable Factories	1906	6,000,000
Polish Siemens Electrical Company	1912	1,000,000
"Volta" Share Company	1899	1,050,000
Total	—	40,650,000

Of these companies the shares of only two are quoted on the Russian Bourses, and even then only formally. The report of the Russian A.E.G. for 1913 states that, 'thanks to a whole series of orders from Government and private establishments, the activity of the company has been very considerably extended. The number of fulfilled orders exceeds by 20 per cent. the turn-over of the previous year, while the number of orders in hand exceeds the total turn-over for 1913.' The reports of the other companies bear witness to similar successes. An illustration of the German methods of combination may be taken from a protocol of a general meeting of shareholders of the United Cable Factories, from which it appears that of a total of 19,200 shares (of 250 roubles each), 6,235 are held by Siemens and Halske, 6,120 shares by the Allgemeine Elektrische Gesellschaft, and 6,120 shares by Felten and Guilleaume. This same United Cable Factories also belongs, together with three other enterprises, to the so-called Abnehmer Syndicate, a syndicate of consumers of copper, which in its turn has contract relations with the Russian copper syndicate, Mied. German capital is also directly interested in a whole series of electrical concerns in Finland, and in this connection it is interesting to note that the realisation of Finnish municipal loans in Germany generally included conditions whereby all municipal orders were to be given preferentially to German firms."—"Board of Trade Journal."

U.S. Electrical Exports for September.—The "Electrical Review and Western Electrician" states that a partial recovery from the severe financial and commercial shock experienced in August is noticeable in the figures for September. Adjustment to war conditions is shown by a gain of over half a million dollars in the electrical export total of September over that of the preceding month. Whereas the August total was but 45 per cent. of that of the corresponding month in 1913, the September total is nearly 69 per cent. of that of September last year. For the four classes for which numbers of articles exported are given in the government reports, there were shipped in September the following: electric fans, 1,502; arc lamps, 60; carbon-filament lamps, 150,731. The values of the various classes of electrical shipments for September and for the corresponding month of a year ago are given in the following table:—

	Sept., 1914. Dollars.	Sept., 1913. Dollars.
Batteries	38,452	63,332
Dynamos or generators	119,756	161,400
Fans	18,029	64,901
Insulated wire and cables	91,375	213,094
Interior wiring supplies, etc. (including fixtures) ...	34,149	70,777
Lamps—Arc	1,472	3,835
Carbon-filament	9,960	29,944
Metal filament	30,988	20,235
Meters and other measuring instruments	14,375	—
Motors	315,115	491,473
Static transformers	26,871	129,480
Telegraph instruments (including wireless apparatus)	3,791	15,164
Telephones	158,922	196,140
All other	685,240	792,473
Total	1,548,468	2,254,254

Appeal.—The Queen's "Work for Women" Fund (33, Portland Place, London, W.) is asking the women of the United Kingdom to forward, by December 16th, a shilling each to the Fund, as a New Year's offering. Sixty workrooms have been started in London, in which employment is being given to thousands of women and girls who have been thrown into distress through the war.

Oldham Corporation Contracts.—At a meeting of the Oldham T.C. on December 2, Councillor C. Hardman (chairman of the Electricity Committee) announced that further correspondence had taken place with the Tudor Accumulator Co., Ltd., who had agreed that money due to them from the Corporation should be paid into the bank to an account in the joint names of the company and the Corporation, and should not be taken out of the bank until the end of the war.

Supplies for the Allied Governments.—We are asked to state that all questions relating to the purchase and export of food supplies, munitions of war, and field equipment, for the French, Belgian, Russian and Serbian Governments, are now dealt with by the International Commission for the Purchase of Supplies (Commission Internationale de Ravitaillement). The Executive Office of this Commission, and the offices of the French, Belgian, and Serbian Delegates thereon, are at India House, Kingsway, W.C., while the offices of the Russian Delegates are temporarily at 192, Cromwell Road, S.W. Application for permission to export goods, the export of which from the United Kingdom is prohibited, should, if such goods are required by the Allied Governments or their accredited Agents, be addressed in writing to the Commission. The Commission will only consider such applications if they are accompanied by documentary evidence as to their official origin. Applications which are unsupported by such evidence, or applications in respect of goods which are ordered by private firms for purely industrial purposes, must be made in the ordinary manner to the Commissioners of Customs and Excise, Lower Thames Street, E.C. Owing to the possible shortage of certain classes of goods for which there is a great demand, it may be found impracticable to make any exception to the prohibition against the export of such goods. Consequently, merchants and manufacturers wishing to supply goods for the use of any of the Allied Governments are warned not to enter into any negotiations until they have ascertained from the Commission Internationale de Ravitaillement that permission for the export of such goods will be granted. Having granted permission to export, the Commission will make the necessary arrangements direct with the Customs Authorities for the clearance of the goods, upon receiving from the manufacturer or merchant at least 48 hours' notice of each shipment, together with the following particulars:—

(1) Nature and quantity of goods to be shipped.
(2) Name and address of consignor.
(3) Name and address of consignee.
(4) Port and approximate date of shipment.
(5) Ship or line by which shipment is to be made.
(6) Port of discharge.
(7) Marks on packages, if any.

Westinghouse Employés and the War.—Up-to-date a total of 1,046 men have left the British Westinghouse Company to join either the Army or the Navy, two of whom have been killed in action. The greater number have, of course, joined the Army Regulars and Territorials. Many have joined the Public Schools Battalion, others have joined the newly-formed Naval Brigade as electrical engineers, and one ex-Westinghouse man has highly distinguished himself, i.e., Mr. Sippe, who was one of the three who set out to fly over, and dron bombs on, the German airship hangars at Dusseldorf in October. In an article in the November number of the "British Westinghouse Gazette" it is stated that from the commencement the Westinghouse Company saw the necessity of helping the dependants of those who have left, and immediately set aside a large sum of money for this purpose. A representative committee was appointed and a very carefully organised scheme evolved, whereby each case is visited and reported upon once every fortnight, and at the present time 422 cases a week are dealt with. In addition to this action by the company, a sum of £1,166 was contributed during the first month of the war by the staff and distributed to the various public relief funds, and a further sum is contributed regularly each week or month by the office and works employés for a stand-by fund; this amounted up to 17th November to no less than £1,705. A rifle range has been erected in the works' grounds on which shooting takes place each day in the dinner hour and on Saturday afternoons. Two butts are at present in use, one of 25 yds. range and the other of 50 yds. range, each accommodating ten men at the one time. An extension to the 50 yds. butts, to accommodate fifteen more men, is practically completed. Only those who are not eligible to join the forces are allowed to shoot on this range; at the present time 1,500 men have passes. An average of 10,000 rounds per week is being fired, and the individual scoring is improving steadily.

Burnley Tramwaymen.—With reference to our note of last week concerning the large number of Burnley tramway employés with the forces, the decision that any further men in the electricity and tramway departments desiring to enlist should give due notice, has been construed as a proposal to stop recruiting, and explanations were demanded at the meeting of the Town Council. It was pointed out that that was not the intention; they wished to preserve the service which was necessary if they were to continue the allowances to the men at the front, which now amounted in the case of the tramways to £80 a week. The Chairman of the Electricity Committee pointed out that most of the men holding responsible positions, and who were invaluable, were young, and that they were being made uncomfortable by the humbugging they got for not enlisting. They were in an awkward position, but the Committee could not do without them. The explanations were accepted.

Constantinople Telephones.—In the course of an article, from an American authority, on "Constantinople Comedies," the "Evening News" on Tuesday stated:—"Turkish controllers .... have not yet seized the telephones, as they would be unable to operate them without foreign assistance."

Glassworkers with the Forces.—The Lemington Glass works, which are principally engaged in manufacturing bulbs for the "Osram" and "Robertson" lamps, have been heavily taxed since the outbreak of the war by urgent Government orders. In addition to the 74 men who have enlisted from the lamp works, a very large number of men have left the glass works to join the army. We understand that the martial spirit among the men is very great, and in this connection, a very large number of bulb blowers having expressed their desire to join the army, the Admiralty were informed that this might entail delay with their work, and the result has been a communication from the First Lord of the Admiralty to the employés of the Lemington Glassworks to the following effect:—

Admiralty, Whitehall, S.W.
5th December, 1914.

I wish to impress upon those employed by your establishment the importance of the Government work upon which they are engaged. I fully appreciate the efforts which the employés are making, and the quality of the work turned out, and I trust that everything will be done to assist the Naval Authorities by pushing on all orders as rapidly as possible.

I should like all engaged by your establishment to know that it is fully recognised that in carrying out the great work of providing for the requirements of the Royal Navy they are doing their duty for their King and Country equally with those who have joined H.M. forces for active service afloat or ashore.

(*Signed*) Winston S. Churchill.

Industrial Disorganisation in Germany.—The "Times" states that the Berlin correspondent of the "Handelsblad," according to a Reuter telegram from Amsterdam, makes some interesting remarks on the economic situation. He says that the disturbance of economic life has caused a far greater disorganisation in Germany than in 1870. German industry is now engaged in meeting disorganisation with reorganisation. The greatest losses have been suffered by the machinery, iron, coal, textile, sugar, paper, and chemical industries. For some industries the problem has been to shift the market for the goods. Other industries had to change the nature of their productions. The great organisations of manufacturers have set themselves "to avoid the dissipation of economic power and to utilise the available power in the most rational manner." They make joint applications when the Government asks for tenders, and are "generally successful in obtaining the orders." The great electrical concerns have, to a large extent, changed their articles of production. Factories which before the war produced iron railings or sewing-machines are now manufacturing shells.

Fulham Men with the Forces.—The following is a list of the staff and employés of the Fulham B.C. Electricity and Dust Destructor Department who are now serving with H.M. Forces:—

Sturley, G. W.	Royal Fleet Reserve.
Herd, G.	Royal Field Artillery.
Ardern, H.	Engineering Section, Naval & Military Arm
Robinson, W.	Royal Garrison Artillery.
Brown, H.	West Kent Regiment.
Baker, W.	East Yorkshire Regiment.
Rogers, E.	Royal Fleet Reserve.
Curtis, J.	Royal Field Artillery.
Tye, F.	Royal Fusiliers.
Ball, A.	Royal Field Artillery.
Churchley, C.	Army Service Corps.
Curtis, W. J.	Rifle Brigade.

Northampton Tramway Managership.—The Northampton T.C. on Monday appointed its electrical engineer, Mr. J. C. Cameron, as manager of the tramways for six months, the question of appointing a permanent manager being deferred until the expiration of that period. Mr. Cameron, who is a son of the manager of the Blackpool and Fleetwood Tramways, has been in the employ of the Northampton T.C for six months. An amendment that advertisements be issued in the technical press, and that the previous resolution of the Council authorising only a temporary appointment consequent upon the resignation of Mr. J. Gottschalk should be rescinded was lost. One member said it was understood that Mr. Gottschalk was to have an opportunity of applying when the permanent appointment was made, and he asked the Council to act honourably in the matter. "A vindictive and unscrupulous opposition has triumphed," he added.

U.S. and South America.—It is stated in a transatlantic contemporary that The Fidelity Company of Baltimore has made arrangements to charter an ocean steamer which will carry a party of business men to the various ports of South America, circling round that Continent and returning through the Panama Canal. The object is to stimulate closer trade relations.

Board of Trade Reports.—No. 100 of the Board of Trade German and Austrian export trade pamphlets deals with volatile and essential oils.

Presents for Men at the Front.—A correspondent of one of the Irish newspapers says that what the men want most in the trenches is electric torches with spare batteries.

Roll of Honour.—Corporal J. W. Hopson, tram driver employed by the Oldham Corporation, has been killed in action in France. He was married about six months ago. The Oldham Tramways Committee has sent a letter of condolence to the widow, who has been offered work as an office cleaner by Mr. Dugdale (manager).

News has reached Halifax that Private Roland Turner, of the 1st Battalion Royal Scots Fusiliers, has been killed in fighting around Poperinghe. The deceased, who was a reservist, was employed as a conductor by the Halifax Corporation Tramways.

Personal.—In the "London Gazette" for December 4th, the following announcements under the Naturalisation Act, 1870, appear for the month of November, 1914:—

Name.	Country.	Date of Oath of Allegiance. 1914.	Occupation.
Jarmay, Gustav	Hungary ..	Nov. 19	Director of Messrs. Brunner, Mond & Co.
Kinzbrunner, Charles..	Austria ..	Nov. 8	Consulting Engineer, and Doctor of Political Economy and Science.
Legrand, Albert Eugene	France ..	Oct. 27	Electrician & chauffeur.
Mannheim, Ernest Arthur	Germany (Naturalised in Australia)	Nov. 4	Mining Engineer.
Moser, William	Belgium ..	Nov. 18	Civil Engineer.
Sandberg, Christer Peter	Sweden ..	Nov. 8	Consulting and Inspecting Engineer.
Sandberg, Nils Percy Patrick	Sweden ..	Nov. 8	Consulting and Inspecting Engineer.
Sandberg, Oscar Fridolf Alexander	Sweden ..	Nov. 8	Consulting and Inspecting Engineer.
Von Chauvin, George ..	Germany ..	Nov. 3	An Engineer.

Mr. Louis Phillippe Lichtenstein, a director of the New British Ever-Ready Co., Ltd., of Holloway, has changed his name to Louis Philip Lightstone by a deed poll dated November 4th, 1914. Mr. Lightstone is a natural born Englishman.

By deed poll executed on Nov. 22nd, Mr. G. F. Metzger, M.Inst.C.E., M.Inst.E.E., M.Inst.M.E., has adopted the surname of Bonnor in place of Metzger, and he will henceforth be known as Gustavus Ferdinand Bonnor. Mr. Bonnor is a British subject, having been born at Dalston, London, some 47 years ago, and it is in order to avoid misconceptions as to his nationality and consequent unfair prejudice that he has made the above alteration. Readers of the "Electrical Review" well know that Mr. Bonnor, as Mr. Metzger, has had a lifelong connection with electrical engineering in England, especially in connection with electricity supply, he having been for many years city electrical engineer at Bath and Manchaster respectively, and we are sure that there will be many expressions of sympathy with him in the very serious position in which the spy mania has placed him. As electrical engineer to the South-East Kent Electric Power Co., Ltd., his duties required him to reside within a fortified area, at Shepherdswell, Dover; but the military authorities, presumably objecting to his German name, ordered him to leave the district. Mr. Bonnor is now temporarily established at Toksowa House, Dulwich Common, London, until the embargo is removed; he is, however, still associated with the South-East Kent Electric Power Co. Mr. Bonnor will be glad if his many friends, from whom he will be very pleased to hear at the above address, will take this notice as official intimation of his change of name.

Mr. Christopher Wade, managing director of Richard Wade, Sons & Co., Ltd., Hull, has gone as a voluntary Red Cross motor-ambulance driver for at least six months. Mr. Wade's brother and ten of the office staff are with the forces.

BUSINESS NOTES.

Consular Notes.—*Concessions in Tripoli.*—Electrical manufacturers are being advised by the United States Consul in Tripoli to follow up the applications which are being made in Rome for concessions to operate lighting and tramway systems in Tripoli. Two Italian electric light companies are jointly endeavouring to secure both concessions.

CEYLON.—*Import Trade Position.*—The official figures of Ceylon's import trade are not very illuminating as regards the different countries which share in the supply of electrical and allied goods. The United States Consul has, however, compiled some figures, from unofficial sources, which give a reasonably exact idea of the relative trade in the various articles from the participating countries:—

Article imported.	1912. Total.	1913. Total.	1913. United Kingdom.	1913. Germany.
Brassware... ...	£21,000	£27,000	*£26,000	£1,000
Cement	†	52,000	25,000	20,000
Copperware ...	5,000	26,000	*5,000	20,000
Electrical materials	24,000	15,000	14,000	1,000
Machinery ...	71,000	246,000	222,000	10,000
Lamps	15,000	18,000	9,000	7,000
Telephone materials	†	3,000	3,000	—

* Includes India. † Not separately classified.

The American Consul considers that his countrymen have a very good chance of increasing their sales in Ceylon. In machinery and tools they have attained some success owing to careful attention to deliveries and packing. He believes the purchasing power of the country to be good just now (Drought threatens a setback.—ED.), as the rubber slump has been counterbalanced by the excellent results from other crops. The standard of comfort among the native population has risen distinctly, and the opening of the Indo-Ceylon Railway promises to solve many problems of labour supply. A description of plumbago mining in the island provokes the comment that this industry has not yet adopted very efficient methods, and suggests a potential demand for winding, pumping and compressor plant.

NEWFOUNDLAND AND NEW BRUNSWICK MARKETS.—In connection with the new trade promotion campaign of the United States Department of Commerce, their Consuls have been devoting considerable attention to the Newfoundland and New Brunswick markets, where they have high hopes not merely of barring Germany as a future importer, but also of weakening Great Britain's position. The chief reasons for the increased importations of American goods into Newfoundland in the past are that local merchants, manufacturers' agents, and importers are taking advantage of the trade literature on file at the United States Consulate; that the more enterprising merchants are sending their buyers to the United States, which was not the case a few years ago; and that American manufacturers are studying the requirements of the Newfoundlanders. This has resulted in the importation of a finer line of goods as regards make, finish, and style. In the opinion of the American Consul, sales of goods can be substantially increased by more persistent efforts and care in filling orders, packing the goods, &c. The fact should be borne in mind that Newfoundland is not a part of Canada. Merchants and importers are averse to having their inquiries and orders for goods referred to a representative in Canada. They prefer to deal direct with the head office or works, claiming that it is more satisfactory as regards prices and freight rates, and that the goods come in better condition on account of less handling.

In New Brunswick, the curtailment of the normal supply of many manufactures of the belligerent countries was not at first of importance, seeing that stocks were fairly full and trade somewhat depressed. Now, however, merchants are becoming optimistic and the future outlook for trade is much brighter. Plans have been made for the usual logging activities during the winter and next spring, and all the mills will run to full capacity during 1915. This also means a resumption of normal business at the stores. There will certainly be an increased demand for electrical goods and supplies and everything connected with mill equipments. Amongst German goods which are under commercial interdiction are electric fancy lamps and tungsten lamps, semi-rotary wing pumps, &c. These German goods have been supplied chiefly through Montreal.

SWITZERLAND.—In a report just issued, from the pen of H.M. Vice-Consul at Zurich, it is remarked that although Switzerland is mainly dependent for her industrial prosperity on exports of her own manufactures, the yearly value of manufactured goods imported into the country is by no means inconsiderable. Last year, the value of her imports of machinery and ironware amounted to £3,536,600, whilst her exports under these headings (including also vehicles) amounted in value to £5,422,000. Year by year, however, Switzerland's imports of manufactures are steadily increasing, notwithstanding that her own manufacturers are also increasing their exports. The Vice-Consul's remarks are based upon the provisional trade returns.

The Vice-Consul says that British manufacturers and exporters still underestimate Switzerland's importance as a market for our goods. The share of the United Kingdom in the imports into Switzerland has not only been small as compared with the total imports from all countries, but shows no sign of proportionate increase. In 1911 the United Kingdom only supplied 5½ per cent. of Switzerland's total requirements, 5·9 per cent. in 1912, and 5·8 per cent. in 1913. This is a poor showing, particularly in view of the frequently-expressed desire both in the Swiss Press and by Swiss merchants, for a more equally balanced trade in return for the large business they do with the United Kingdom. Only recently one of the principal Swiss exporters to the United Kingdom and her Colonies expressed to the Vice-Consul the opinion that the imports of British goods could certainly be considerably increased if British manufacturers would follow the example of the German commercial traveller, and study German methods and terms, or at any rate establish branches or agencies in the principal Swiss towns. In his opinion British manufacturers are either unaware of, or indifferent to, the very sympathetic attitude of the Swiss consumers towards British goods, particularly among the well-to-do classes.

The Vice-Consul has prepared a list of articles in which the United Kingdom already does an export business to Switzerland to a certain extent; but it is only reasonable to assume that with increased efforts a much larger trade might be done therein. In this list figure machinery, ironware and metal goods generally, india-rubber goods and instruments.

No stronger hint as to the best method of improving our trade could be furnished than by the record of the number of commercial travellers who applied for the requisite Swiss licence last year. Foreign countries were represented by a total of 7,040, of which Germany applied for 5,000, France 1,500, and the United Kingdom only 72. A personal investigation of the requirements of the Swiss market is most desirable. The principals of firms, or their representatives, might first call on the British Consuls, who would be able to assist them in giving information as to the chief firms engaged in their branches of commerce.

If, however, it is not possible to send travellers, the appointment of Swiss agents, able to correspond in English, would be the most likely way of securing a better share of trade. A further aid to the development of British trade in Switzerland would be the sending of price lists and circulars in the French or German language. In the great majority of instances in which catalogues in the English language are sent no results can be expected. Price lists should be compiled with the weights and measurements given in kilogrammes and metres, and the prices quoted in francs, the

latter including freight and duty to destination. It is still necessary to emphasise the uselessness of drawing up these price lists giving our English weights, measures and currency. If it is desired to open up business connections with good Swiss business firms, it will be necessary to meet them as regards terms of credit, and to accept sample orders as a commencement. The usual Swiss terms of credit are three months net. German manufacturers, however, in order to open up business with new customers, will extend the term of credit to one year, or even longer. They likewise instruct their travellers or agents to accept sample orders, thus frequently securing permanent customers.

The principal towns visited by commercial travellers are Zurich, Basle, Berne, Geneva, St. Galle, Lausanne, Lucerne, Winterthur, La Chaud-de-Fonds and Bienne.

Our Consul at Geneva, in dwelling on the opportunities which might be watched for by the representatives of British firms, points out that although the Cantonal Government restrict their calls for tenders to firms established in the canton for a certain number of years, they do not restrict the origin of their supplies to a certain country, but permit local tenderers to order them as well from the United Kingdom as from any other country. Amongst articles frequently required by the tenderers are plant for central heating, plant for electric lighting, reinforced concrete, &c.

According to a Swiss trade journal, the future of the Swiss machinery industry is becoming more and more dependent upon the trade with foreign countries. The demand at home for Swiss machinery declined considerably during the year 1913, but this falling off was compensated for by orders received from abroad.

The journal adds: "This result would not have been achieved but for the excellent organisation which exists for the promotion of our Swiss export trade, and by which new markets are continually being opened." Ample testimony to the truth of this is afforded by the detail statistics of Switzerland's electrical exports, which we shall shortly publish.

The various factories engaged in the machinery trade were busily employed during the year 1913, and it was anticipated that this year would show a similar result, in spite of a restriction of orders from Germany early in the year. The war, however, has naturally upset these expectations. On the electrical side, however, a considerable increase in home orders is expected, as the Federal railway department has decided that a portion of the Gotthard line (from Erstfeld to Bellinzona) shall be electrified. The introduction of the electric system will involve the establishment of several large water-power stations. One station has already been commenced at Airolo with 50,000 H.P., and a central station at Amsteg with 32,000 H.P.

Liquidations.—Apparatus and Accessories, Ltd.—A meeting of creditors is called for December 16th, at 119, Finsbury Pavement, E.C., under the Companies' (Consolidation) Acts, 1908, 1913.

The Oldham Boiler Works Co., Ltd.—This company is winding up voluntarily, with Mr. H. Hague, of Retiro Chambers, Yorkshire Street, Oldham, as liquidator. A meeting of creditors is called for December 17th.

General Electrolytic Parent Co., Ltd.—It is stated in a provincial paper that a meeting is called for December 14th to consider a resolution for voluntary liquidation.

The Midland Electric Corporation (1900), Ltd.—A meeting will be held at the North-Western Hotel, Lime Street, Liverpool, on January 12th, 1915, to hear an account of the winding up from the liquidator, Mr. H. E. Abbott.

Bankruptcy Proceedings.—G. E. Hipkins, electrical engineer, Dudley.—First meeting, December 11th, Official Receiver's Offices, 1, Priory Street. Public examination, January 5th, Court House, Dudley.

A. J. Loader, medical electrician, Nelson, Lancs.—First meeting and public examination, December 18th, at the County Court House, Bank House Street, Burnley.

Private Arrangements.—Llanelly Motor and Electrical Engineering Co., Ltd.—In pursuance of Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors interested herein was held on Thursday, December 3rd, at 28, Baldwin Street, Bristol, when it was stated that the company was incorporated in October, 1912, with a nominal capital of £5,000 divided into 900 preferred ordinary shares of £5 each and 500 founders' shares of £1 each. Of the preferred ordinary shares 358 have been issued for cash; the founders' shares were all allotted as fully paid. The statement of affairs showed that the total sum ranking for dividend was £2,437. The net assets were £2,325, or an estimated deficiency of £112. The present position was attributed to loss on trading, depreciation in stock and bad debts. It was resolved that the company be wound up voluntarily, and that the appointment of Mr. Arthur Collins as liquidator be confirmed. A small advisory committee representing the creditors was appointed to act with the liquidator in realising the estate.

British-Made Indicators.—Messrs. Gent & Co., Ltd., of Faraday Works, Leicester, ask us to remind contractors who have been in the habit of buying German electric bell indicators that they now have on the market an entirely new pattern of pendulum indicator, which has been specially got up to meet the demand for a cheap indicator, and which can be guaranteed to be of British manufacture throughout. Contractors should ask their factors for details of this indicator.

For Sale.—A quantity of electrical apparatus, including motors, cable, telephones, &c., will be sold by auction on December 16th, at Dalling Road, Hammersmith, by Messrs. P. Huddleston and Co. Particulars are given in our advertisement pages to-day.

Catalogues and Lists.—Messrs. W. Geipel & Co., Vulcan Works, St. Thomas Street, London, S.E.—List No. 136 (ten pages) giving illustrated descriptions and prices of their automatic time switches and flashers. The "Arbiter" time switch is arranged for switching on by hand, and off automatically, and is suitable for the restricted hour or two-rate system; the "Opus" time switch is arranged to switch both on and off automatically, and is used for street sign lighting, &c.

American Hard Rubber Co., 13A, Fore Street, London, E.C.—Current price list of ebonite, sheet, rod and tubing, of which large stocks are carried.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—36-page catalogue (Section VIII, part 3) of electric heaters and radiators (Quartzalite, Dowsing, Ediswan, luminous, convector, hot-bar, &c.) embodying a number of additional lines introduced since the issue of the last season's list. Prices generally are revised consequent upon raw material costs. Measurements, weights, finishes and prices are clearly indicated.

Messrs. Falk, Stadelmann & Co., Ltd., 83/87, Farringdon Road, London, E.C.—Abridged edition of their general electrical catalogue. It consists of 72 pages, and has been issued specially for the use of supply authorities and contractors. A varied collection of designs of electric light fittings for residence lighting, also statuettes, radiators and outside lantern fittings are illustrated and priced. The trade can obtain supplies of this catalogue for householders' purposes on application.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Filing cover containing a number of illustrated price lists of electric cooking appliances, including cooking disks, boiling plates, stewpans, grills, breakfast cookers, electric ovens in three sizes, and electric cookers in two sizes.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—December stock list of single, two and three-phase motors.

Trade Announcements. — Messrs. Scholey & Co., Ltd., have been appointed the British representatives of the Taylor-Stoker interests, which are controlled in the U.S.A. by the American Engineering Co.

The British Mannesmann Tube Co., Ltd., have removed their offices to their permanent address at Corporation Road, Newport, Mon.

The offices of Venner's Electrical Cooking and Heating Appliances, Ltd., have been removed to their new works:—Venelectric Works, 66 and 68, Wandsworth Road, London, S.W., where all communications should be addressed.

The offices of Messrs. Rushmore Lamps, Ltd., have been transferred to their works at Peterborough Road, Parson's Green, Fulham, S.W., where all communications should be sent. Telephone numbers: Putney 2490 and 2491; Telegraphic address: "Aplanatic Ful," London.

Book Notices.—"*Proceedings* of the Engineering Association of New South Wales," Vol. XXVIII, 1912-13. Sydney: The Association.

"*Journal* of the Institution of Electrical Engineers," Vol. LIII, No. 237. London: E. & F. N. Spon, Ltd. Price 3s. 6d. The issue for December contains the following papers:—"Experiments on the Heating of Screw-socket Lampholders," by C. C. Paterson; "Temperature Rise in Twin Flexible Wires," by S. W. Melsom and H. C. Booth; "Electric Cooking and Heating in Private Houses," by W. A. Gillott; and the inaugural addresses of the President, Sir John Snell, and Messrs. P. P. Wheelwright, T. Roles, and J. Lowson.

Exports from Sweden.—The exports of electrical machinery and apparatus from Sweden during the nine months ending with September last attained a value of only £140,596, as contrasted with £180,470 in the corresponding period of 1913. On the other hand, the shipments of telephone material advanced from £231,934 to £255,900.

Deed of Assignment.—R. Crust, electrical engineer, 40, Brook Street, Bradford.—Trustee, P. Hodgkinson, 48, Sunbridge Road, Bradford. Creditors must send particulars of debts, &c., by December 28th.

Fire.—On Saturday night fire broke out in the fan-house at Belside Colliery (Northumberland), and spreading to the electrical room soon had the whole of the machinery building in flames. Before the fire was subdued, the whole of the machinery had been converted into scrap.

Hart Battery Works in Canada.—The Canadian Hart Accumulator Co. has begun the erection in St. John, New Brunswick, of a large factory for the manufacture of accumulators for the Canadian market.

LIGHTING and POWER NOTES.

Ardsley.—Proposed E.L.—The U.D.C. has decided to ask the Electrical Distribution of Yorkshire, Ltd., to submit a scheme for lighting the district by electricity.

Barnsley.—The Corporation electricity mains are to be extended at a cost of £329 to supply current to the new Mount Vernon Sanatorium and the open air schools.

Birmingham.—The demand for electric power by the manufacturers in the city engaged on Government contracts has increased to such an extent that the Electricity Supply Committee is specially considering the subject with a view to meeting the situation.

Blackpool. — NEW PLANT. — The Tramways and Electricity Committee has appointed a deputation to visit various towns to inspect and report upon modern types of boilers.

Bolton.—STREET LIGHTING.—The T.C. has accepted the tender of the Electricity Committee for lighting Long Lane, Darcy Lever. The Gas Committee also tendered.

Boston.—PROV. ORDER.—Mr. W. B. Cownie, of the National Electric Construction Co., Ltd, who intends applying for a prov. order for E.L., has submitted his proposals to the Paving and Lighting Committee, which was favourably impressed.

Bradford.—The Electricity Committee has concluded an agreement with Messrs. John Best & Sons, Ltd., with respect to a bulk supply of electricity in connection with the tunnel for the outfall sewer from Frizinghall to Strangford.

The offer of Messrs. Clough, Smith & Co., Ltd., to erect an overhead transmission line between Frizinghall and Esholt, has been accepted; also the offer of the Sturtevant Engineering Co. to supply a filter of a larger capacity than the one previously ordered for the 5,000-KW. turbo-alternator at the electricity works.

The Baths Committee is arranging for the Tong Street Cottage Baths to be lighted by electricity.

Buckinghamshire.—The C.C. has referred to the Parliamentary Committee the Bill of a London electric company, which affects Beaconsfield, Eton, Slough, and rural parishes near Amersham, High Wycombe and Chesham.

Burton-on-Trent.—The Electricity Committee of the T.C. has resolved to appoint its electrical engineer as agent to the Corporation in connection with the hiring out of electric radiators, outside lamps, motors, &c.

Canada.—In a report of the coal mines branch of the Alberta Department of Public Works, for 1913, it is stated that electricity was used at 29 mines in 1913, of which 10 were situated in the Crow's Nest Pass district. The horse-power of electrical apparatus in use was 4,228 above ground and 1,147 below ground. Four electrical and 163 compressed-air coal-cutting machines were in operation, producing 120,870 and 848,481 short tons respectively.

New regulations governing the construction and erection of electric signs have been adopted by the Montreal Council. The by-law forbids the illumination of signs except by means of electric bulbs forming each letter or figure of the advertisement. The by-law applies to signs hanging more than 6 in. from the buildings; the signs must not protrude more than 6 ft.; the space to be illuminated is fixed at not less than 75 per cent. of the total area. The electric wiring and fixtures must be passed by the Canadian Fire Underwriters' Association.—*Canadian Electrical News.*

Carrickmacross. — STREET LIGHTING. — The electric lighting installation is nearing completion, and it is proposed to have 50 and 100-C.P. lights in different parts of the town for public lighting.

Chippenham.—STREET LIGHTING.—The T.C. has decided to ask the Electric Supply Co. to quote terms for lighting 31 lamps which have been added to the borough through the extension of the district.

Colwyn Bay.—PROPOSED LOAN.—The T.C. has decided to make application to the L.G.B. for a loan of £35 000, for the purpose of extending the electricity works. The extensions will include the erection of a new refuse destructor and generating station, and the new works will be equipped with turbine plant of 1,500 KW. capacity at 6,000 volts, energy being transmitted by underground cable to the present works.

Dover.—LOAN SANCTION; NEW PLANT.—The T.C. has received L.G.B. sanction to a loan of £1,000 for cables. A five years' agreement from March 31st next has been entered into with the Board of Works for energy for the Duke of York's School. If the annual consumption is 30,000 units, the price is to be 3¼d. per unit, and if that number of units is exceeded, 3d. If, through the school not being in use, the consumption is below 30,000, the charge is to be 4¼d., with a minimum payment of £150. The mains are to be extended so as to supply the new military huts at Northfall and Long Hill. The war department will pay the cost of the extension, £172, and undertake the wiring work. In order to meet the increasing demand for current it is proposed to install a 1,000-KW. turbine set.

Dublin.—The Corporation Electricity Supply Committee has cancelled its contract with a Nuremberg firm for arc lamp carbons, and has purchased, at an increased cost, 2,000 pairs of carbons from the London Continental Stores Co.

Durham.—COLLIERY ELECTRIFICATION.—The South Moor Colliery Co. has decided upon a comprehensive scheme for the complete electrification of its group of collieries in the Annfield Plain and Shield Row district of the Durham coalfield. The installation at the outset will consist of two 750-KW. mixed-pressure turbo-generators, one of which will be placed at the Crag Head group of collieries, which are also being electrified, and the other at the Louisa Pit. The whole of the collieries will be linked together by a ring main, and a complete equipment of pumping and hauling machinery will be installed. The scheme is to be carried out under the direction of Messrs. W. C. and K. A. Mountain, as consulting engineers.

Eastbourne.—CAMP LIGHTING.—The T.C. has decided to extend the mains in order to light the military camp in Summerdown Road; about 500 lights will be utilised.

The electrical engineer reports that if any more of the skilled workmen enlist it will be very difficult to keep the works going, as there is now great difficulty in replacing them. The Council has decided that before any more of the staff enlist the consent of the Electricity Committee must be obtained.

Eccles.—The T.C. has received sanction to borrow £3,000 for mains and £450 for a coal conveyor and elevator. The Electricity Committee expresses the opinion that the present is an inopportune time for the promotion of the I.M.E.A.'s proposed Bill, but it is prepared to consider the question of giving support to the Bill if introduced in the near future. The Committee has deferred the consideration of the question of contributing to the costs of the action of the Ilford U.D.C. with the Gas Co. pending the receipt of further information thereon.

Farnworth.—The U.D.C. has consented to the Lancashire Electric Power Co.'s supplying electrical energy to the Bolton Textile Mill Co.'s new mill in Gower Street, Farnworth, until the expiration of the agreement between the Council and the company. The Power Co. has informed the T.C. that it is taking steps to prevent as far as possible any interruption of the supply of current by installing suitable apparatus.

Grappenhall.—PROV. ORDER.—The P.C. has decided not to object to the Warrington Corporation's application for a prov. order.

Hayle.—OVERHEAD MAINS.—The U.D.C. has granted the Cornwall Electric Power Co. permission to erect overhead lines in the town for the transmission of energy.

Hereford.—Subject to the consent of the B. of T. and the R.D.C. being obtained, the D.C. has decided to supply Tupsley Court; if wayleaves over fields are secured, an overhead line will be used.

Holmfirth.—OVERHEAD MAINS. — The U.D.C. has applied to the B. of T. for consent to use overhead lines throughout the district for the transmission of current at a pressure of 460 volts.

Hove.—The Lighting Committee has resolved to reduce the charge for power and heating to a flat rate of 1·5d. per unit from January 1st next, and the meter rent by 1s. per quarter from the same date.

Irvine.—E.L. SCHEME.—Plans for an electric substation have been passed by the Irvine Dean of Guild Court. The building will contain static transformers which will reduce the voltage of the current coming from Kilmarnock to Irvine from 1,100 to 415 volts. The engineers expect to be able to supply current to consumers by Christmas.

Knaresborough.—PROV. ORDER.—The U.D.C., at a special meeting on Monday, passed a resolution confirming the decision to apply for a prov. order for electricity supply. A motion to defer the matter for six months was rejected.

Leigh (Lancs.).—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £3,000 for the purposes of the electricity undertaking.

Leyton.—WINDOW LIGHTING.—Owing to the police order prohibiting outside shop lights, the electrical engineer has received applications for a supply of current for window lighting. As this appears to be temporary, until outside lighting can be used again, the engineer has, in those cases in which a new service is required, made a charge of £2, to be refunded at the end of three years if the installation is used regularly during this period.

London.—POPLAR.—The Electricity Committee has decided to carry out cable extensions, at an estimated cost of £6,922, £500 being for switchboard extensions. The net profit of the undertaking for the half-year ended September 30th last amounted to £2,414, compared with a loss in the corresponding period last year of £129.

BATTERSEA.—The B.C. is to apply to the L.C.C. for sanction to a loan of £9,000 for mains, services and meters for the electricity undertaking.

The L.C.C. has consented to the retention of the coal-handling plant, across Lombard Road to the electricity generating station, for a further period of 10 years.

L.C.C.—The Finance Committee recommends sanction to a loan to the St. Pancras B.C. of £8,970 for mains, plant, house services, meters and lamps on hire.

GREATER LONDON ELECTRICITY SUPPLY. — The Stepney B.C. is supporting the Hammersmith B.C. in its efforts to obtain the postponement of the London electricity supply scheme, at least until the session of 1915. The postponing of the scheme is also urged by the Fulham B.C., the Middlesex C.C., and the Staines and Walton U.D.C.'s.

Middleton.—Proposed Loan.—The T.C. has decided to make a supplementary application to the L.G.B. for sanction to borrow £273 for extensions at the electricity works.

Nutford and Lothingland.—Workhouse Lighting.—The B. of G. has decided to obtain from the Oulton Broad Electricity Co., Ltd., an estimate for installing 170 lights at the Workhouse, and also for the supply of energy.

Runcorn.—E.L. Scheme.—The R.D.C. has appointed a Sub-Committee to consider an application of the Warrington Corporation for consent to the grant of the E.L. extension order for the supply of electricity to various rural parishes.

Salford.—Street Lighting.—The Electricity Committee has decided to supply energy to the Prestwich U.D.C., for street lighting purposes, on the Polefield Hall estate, at 1¼d. per B. of T. unit.

Sheffield.—Proposed Loans, &c.—The Finance Consultative Committee has been requested to approve a supplementary estimate of £25,000 on capital account in respect of mains for the year ending March 25th next. Application is to be made for sanction to borrow £85,400 for the provision of additional plant at Neepsend power house. From this year's working of the electricity undertaking, the Committee expects a surplus of £8,359, out of which £2,800 will have to be provided in respect of cooling towers, £550 for a motor lorry, and £1,600 as a proportion of costs of the Corporation Act of 1912. For the year 1915-16, although the estimated gross profit shows an increase of £21,949 as compared with the present year, the estimated surplus for the 12 months is put at £4,252, a decrease of £4,107, accounted for by the fact that the figures in respect of the interest are estimated at £50 846, as against £38,750, and in respect of the sinking fund, at £56,834 as against £42,874.

Skerries (Co. Dublin).—The electric lighting scheme is expected to be in operation in January next.

Southport.—Arc Lighting Suspended.—Owing to a shortage in the supply of lamp carbons, the Electricity Committee has decided to suspend the whole of the street arc lighting in the town until further notice.

Stockton-on-Tees.—Bulk Supply.—The T.C., in order to meet the increasing demand for current, has decided to purchase from the Cleveland and Durham E.P. Co. a minimum of 1,000,000 units per annum. The agreed price was not made public.

Stretford.—Street Lighting.—The Electricity Committee recommends the adoption of a scheme for the improvement of the lighting of Chester Road by substituting 2,000-c.p. half-watt lamps for the old Brockie-Pell arc lamps, at an initial cost of £80 and an additional cost of £192 per annum for energy and maintenance.

Stroud (Gloucester).—The company holding the prov. order for E.L. for the district is negotiating for a site adjoining the U.D.C.'s refuse destructor on which to erect a generating station.

Swinton and Pendlebury.—Street Lighting.—The U.D.C. has decided to introduce the Barrow system of electric lighting over the whole of the tramway route in the district. It is intended to have the scheme in full operation in January.

Torquay.—Loan Sanction.—The L.G.B. has sanctioned loans of £13,808 for new plant for the electricity works, and £2,052 for buildings.

Tunbridge Wells.—The borough electrical engineer has been instructed to report upon the question of the charging of electric accumulators.

Turton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,060, representing excess expenditure by the Electricity Committee up to March 31st last; £2,150 for prospective expenditure on mains; £250 on services; and £100 on meters.

Uxbridge.—Sewage Pumping.—The U.D.C. has decided to adopt electric power for driving the pumps at the sewage works, and to enter into a contract with the Uxbridge and District Electric Supply Co., Ltd., for a term of three years. It is proposed to install an electric motor, coupled direct to the pumps, at a cost of £71.

West Ham.—The Town Clerk reported that the arbitration in the matter of the Council's dispute with the Hart Accumulator Co., with reference to amounts deducted by it from the electricity accounts on account of the alleged interruptions of the supply of current, had been proceeded with, and that the arbitrator had found against the Corporation on the ground that it had committed breaches of the agreement between itself and the company, and that the Council was liable for damages in respect thereof. In this connection the Electricity Committee reports that the arbitrator stated his award in the form of a special case, and having considered the advisability of setting down the case for argument in the Courts, and in connection therewith, having also considered the opinion of counsel engaged by the Corporation on this point, the Committee recommends that the solicitors be instructed to proceed with the special case.

Witney.—Messrs. May & Hawes, the Council's consulting engineers, have written pointing out that the actual expenditure incurred on the scheme has been £6,819, as against the estimate of £6,800, despite certain extra work being carried out.

Whitstable.—Electric Supply Inaugurated.—On Saturday last the undertaking of the Whitstable Electric Co., Ltd., was inaugurated. The company, formed locally at the beginning of the year, entered into an arrangement with the U.D.C., by which the generating plant is housed in the brick building put up to contain the sewage pumping plant belonging to the Council.

The generating plant consists of two 50-kw. Crompton dynamos driven by Hornsby horizontal single-cylinder suction gas engines, of ample size to give suitable overload capacity. These operate in conjunction with a 130-cell D.P. battery of 400 amp.-hours capacity, and a 10-kw. booster is provided. The switchboard, by Messrs. Crompton, is double-pole, and is provided with double bus-bars in anticipation of a possible power load from the harbour. In addition to the generator panels there are three feeder panels and one each for the battery and booster.

A feature of the Whitstable undertaking is that the mains are wholly overhead. About six miles of route have been equipped, with wooden poles and bare copper, the only exceptions to the latter being certain insulated spans crossing telephone wires. The feeders are arranged horizontally and the distributors in a vertical plane on the poles; an earth wire is carried along over the other wires, and is earthed at each pole by a galvanised iron earth wire, lightning arresters being provided in the station. The pressure of supply is 230 volts at the consumers' terminals.

The contractors for the entire installation were Messrs. J. B. Saunders & Co., Ltd., of Westminster, and the work has been carried out under the direction and supervision of Messrs. Burstall and Monkhouse, also of Westminster, the company's consulting engineers, to whom we are indebted for these particulars.

The undertaking starts with a street lighting load, 120 single and a dozen three-light brackets having been installed, to light about half the town; furthermore, the company has a contract with the Council for sewage pumping, for which plant is being installed.

The tariff for lighting is a flat rate of 6d. per unit, but in view of the large amount of small property in the area, it is intended in the case of small houses to put in lamps at 10s. per lamp per year for two or three-light consumers, of whom there will be a good many. One result of the introduction of electricity into the area has been a reduction in the price of gas, which took place as soon as the company started operations.

TRAMWAY and RAILWAY NOTES.

Australia.—N.S.W. Tramway Returns.—The Chief Commissioner, reporting on the working of the railways and tramways for the quarter ended September 30th last, states that the tramway earnings were £430,447, and the working expenses £407,628, representing increases as compared with the previous year of £50,435 and £20,718 respectively. The passengers numbered 70,782,671, a decrease of 1,809,566; the miles open were 215.

Barnsley.—Tramway Accident.—At the inquest held on two women who died from injuries received in the "runaway" accident mentioned in our last issue, evidence was given that just before the car started the driver went to speak to the driver of another car, and the conductor hearing the gong sounded, believed it to be his driver's signal and released the brakes, with the result that the car ran away. The jury's verdict was "Accidental death, owing to the carelessness of the driver and conductor," and they added that the driver should not leave the car without informing the conductor, and the latter should not release the brakes until he knew the driver was on board.

Bristol.—The Tramways and Carriage Co., Ltd., is applying for an extension of time for the construction and completion of lines included in the Act of 1911.

Clayton-le-Moors.—The Council has given its support to the extension of time that is being sought by the promoters of the Clayton-le-Moors Light Railway.

Dewsbury.—Tramway Extension.—The T.C. has decided to promote a Bill in Parliament authorising the construction of an additional tramway and to confer further powers with regard to the tramway, electricity and other undertakings.

Edinburgh.—Tramway Purchase Proposal.—At a meeting of the Corporation Tramways Committee, the question of acquiring the tramway undertaking in the city before the expiry of the company's lease was considered, and after discussion it was agreed that no action should be taken in the matter. The company's lease does not expire till 1919. The company, it is understood, stated that it considered the value of its concern was £292,742, and it was willing to sell the undertaking for £250,000. The offer included the cars at cost price, stores and property as valued in the last balance-sheet of the company, and amounts equal to four years' profits and four years' directors' fees. According to a statement prepared by the City Chamberlain, the purchase of the undertaking at the figure put forward by the company would involve a loss of £70,000 to the ratepayers, as compared with the price the Corporation would have to pay on the expiry of the lease.

Proposals dealing with additional routes and extensions of methods of traction, including one regarding the provision of tramways to Queensferry, were remitted to the city engineer for report.

Hove.—Railless Traction Scheme.—The T.C. is being recommended to enter into an agreement with the Brighton Corporation for an extension of time for the construction of the through routes of the railless traction scheme, for a further period of six months, on condition that the latter Corporation agrees to defer making application to the B. of T. for the appointment of an arbitrator.

Leigh (Lancs.).—A deputation of the Corporation has been appointed to visit other towns to obtain information as to the running of motor-'buses and railless trolley cars.

Manchester.—Effect of the War.—At a recent meeting of the Tramways Committee an interesting review of the war's effect upon the tramways of the city was given by Mr. J. M. McElroy, the general manager, showing that the number of employés now with the colours was 1,153, and these were costing the department in wages £823 per week, equal to £42,769 per annum. The revenue since the outbreak of war had been seriously affected, and, as compared with the corresponding period from April 1st to the present date, the receipts had fallen by £12,800. From April 1st to the outbreak of the war the receipts showed an increase of between £6,000 and £7,000, but since the war this had been swallowed up, and they were now £12,000 below last year. As to the suggestion that the Committee should provide free travelling facilities for members of the City Battalions, Mr. McElroy pointed out that the policy of the management had been that where men were living at home, or were billeted some distance from the place of drill, tokens were issued whereby they travelled morning and night free of charge, but this was not done if the men were in camp. They had issued tokens representing a value of £1,777, equal to 426,000 journeys.

Sheffield.—In view of the report of the tramway manager on the power brake which had been in service on one of the cars during the past fortnight, the Tramways Committee has decided to accept the offer of Messrs. Cole, Marchant & Morley, Ltd., to supply nine of these brakes at £100 each. The Committee expects to derive a total income from the tramways for the year ending March 25th next, of £382,520, as against an expenditure of £317,688. The estimates for the year ended March 25th, 1916, show a slight decrease, the figures being £368,069 and £339,481 respectively.

The Corporation is to promote a Bill in Parliament to construct a tramway from Bawtry Road and Sheffield Road to the city boundary at Tinsley; to give the Corporation running powers over the Rotherham Corporation tramways from Weedon Street to the city boundary at Templeboro; to secure power to purchase the Rotherham Corporation tramways within the city, and power to run motor-omnibuses from the city boundary at Handsworth Bridge to Aston.

York.—With a view to facilitating the carriage of stores, the military authorities have asked the Corporation to extend the tramways from Lendal Bridge to the railway goods station, and from Fulford Road to the Ordnance Stores, and have offered to advance the necessary money for carrying out the work. It is estimated that the scheme will cost £4,700.

TELEGRAPH and TELEPHONE NOTES.

Alien's Wireless Installation.—The Court-Martial held at Woolwich on November 17th, on Harold Fochtenberger, who was accused of having wireless telegraph apparatus in his possession without permission, passed sentence of six months with hard labour, but this was remitted, and a sentence of three months' detention without hard labour was substituted.

Another Wireless Torpedo.—It is reported from the United States that the Government has under consideration the purchase of the radio-controlled torpedo-boat *Natalia*, the invention of John Hays Hammond, jun.

Australia.—As the Postal Department is incurring an annual loss on the working of the telephone system throughout the Commonwealth, an increase in the tariff is inevitable. The total deficit last year was £221,756, more than half of which arose in New South Wales; of the capital towns, only Sydney shows an excess of expenditure over revenue. The latest estimate of the total number of stations in the Commonwealth is 119,000. One of the principal causes of the loss is the large proportion of small exchanges which are kept continuously open, though the amount of traffic is small.

Post Office Telegraphs.—In the report of the Postmaster-General, briefly summarised in our last issue, it was stated that the number of telegraph offices open on March 31st, 1914, was 14,152, an increase of 108. The number of ordinary telegrams transmitted was 69,441,000, a decrease of 1,203,000, and the receipts were £2,146,673, a decrease of £37,439, as compared with the previous year; for Press telegrams the figures were 4,194,000 (− 153,000) and £140,619 (− £7,281); foreign telegrams 11,471,000 (+ 12,000) and £533,115 (− £3,182). The total shows a decrease in traffic of 1·6 per cent. for the year. At 6,257 offices where the traffic is light, the telephone has been substituted for the telegraph; at 2,197 of these offices the same instruments are also used for public telephone calls. The system is being installed in 432 other offices, and its installation at 800 more is under consideration. Joint extensions of the telephone and telegraph systems are now made where the traffic would not have justified the provision of either service alone, and the average cost of such extensions has fallen from £56 to less than £40.

The dispatch and delivery of telegrams for telephone subscribers by telephone is increasing, over four million messages having been so dealt with during the year. Manual typewriters are now used generally at large offices for typing telegrams, over 300 being in use, in addition to the direct printing telegraph instruments. High-speed telegraph apparatus has now reached a high state of development; for Wheatstone working the Gell perforator has been standardised, and the Creed reperforator and printer has been much improved. Sextuple-duplex working, which gives six separate channels in each direction on a single circuit, has been applied to the Baudot system experimentally between London and Birmingham, and quadruple-duplex sets will shortly be installed between London and Liverpool and Glasgow. A new form of Murray multiplex apparatus is being worked experimentally between London and Manchester.

The main underground telegraph system is approaching completion, and as the standard of maintenance of overhead wires has been improved the number of interruptions on these has been lessened. Many phantom circuits have been provided for telegraphing over the trunk telephone lines, which are very substantially constructed and less likely to be interrupted than the lighter telegraph lines. The coast communication system has been considerably improved.

Telegraphic communication with the Continent has been improved by laying a new four-wire cable to Germany, and by the extension of multiplex working on the Baudot system.

The provisions of the International Radio-Telegraph Convention of June, 1912, came into operation on July 1st, 1913. At the end of the financial year there were 879 ships registered in the United Kingdom equipped with wireless telegraphy under licence from the Postmaster-General, as compared with 646 in the previous year. New coast stations were opened at Land's End and Fishguard in place of those at the Lizard and Rosslare, and new stations will shortly be opened at Valentia and in Guernsey. To provide against interruption of the telegraph lines to Aberdeen and the north of Scotland, a high-speed wireless station is to be erected near Stonehaven, to work in connection with that at Cullercoats. A licence has been issued to the Marconi Co. for commercial wireless service between Poldhu and Spain; and licences are under consideration for the new Marconi station in North Wales (communicating with a new station at New Jersey, U.S.A.), and one on the west coast of Ireland, which is being constructed by the Universal Radio Syndicate (Poulsen system) for communication with Canada.

A revised agreement was made with the Marconi Co. on July 30th, 1913, for the construction of high-power stations in England, Egypt, East Africa, South Africa, India and Singapore, at a cost of £60,000 each, plus a royalty of 10 per cent. of the gross receipts so long as any valid Marconi patents are used (not exceeding 28 years). The sending aerial in this country is being erected at Leafield, near Oxford, and the receiving aerial at Bishop's Cannings, near Devizes. Sites have also been secured in Egypt, at Abu Zabal, near Cairo, and Abu Sueir, near Ismailia; in India, near Poona; in East Africa, near Nairobi, and in the Transvaal.

During the year 184 new telephone exchanges were opened, compared with 55 in the previous year, and 44,058 stations were added to the system, an increase of 6 per cent., compared with 29,638 (4·2 per cent.) in 1912-13. The total number of exchanges on March 31st was 2,831.

Of 1,905 new public call offices, 1,348 were provided with full facilities for trunk line service, and 90 with partial facilities. Arrears of construction work are almost overtaken; 20 of the National Telephone Co.'s London exchanges have been replaced by new ones, and four large exchanges are in hand. The trunk system was increased by 106 new exchanges, 456 additional circuits, and 47,279 miles of wire, and the trunk calls increased by over two millions. It has been necessary to commence an underground telephone cable between London and Birmingham and Liverpool, as well as other cables between important centres. Last December a cable 72 miles in length—the longest submarine telephone cable in the world—was laid across the Irish Sea, affording three, or perhaps four, additional circuits. At the end of the year the expenditure on trunk lines amounted to £7,578,026. On November 1st, 1913, great reductions were made in the charges for calls between England and France, and the number of calls increased by 20 per cent., to 184,277. The telephone traffic to Belgium increased by 25 per cent., to 62,520 calls. Communication has been opened between London and Switzerland, and a direct Anglo-Dutch cable will be brought into use next year. Three automatic telephone exchanges are being constructed, and eight more are about to be commenced. Rural subscribers (farmers' lines) numbered 2,242 on March 31st.

The total mileage of Post Office wires, including spares, was 2,886,025 miles, an increase of 8·4 per cent. Of this, telegraphs accounted for 267,252 miles, telephones for 1,846 565 miles, and spares for 772,208 miles of single wire; while aerial wires measured 947,392 miles, underground 1,926,743 miles, and submarine 11,890 miles.

The net loss on the working of the telegraphs for the year is estimated at £1,230,956, and the net profit on the telephones at £272,643.

Secret Wireless Station.—A Court-Martial was held at Hull, on December 6th, on Archibald George Cocks, of the Bungalow Aerodrome, Filey, who was charged with having wireless apparatus in his possession without permission. Evidence was given as to the finding of apparatus in the prisoner's house, capable of receiving signals. The prisoner said he was a British subject and British born, and had used the apparatus for lecturing to Boy Scouts.

South America.—It is stated by the Pan-American Union that there are 120 wireless stations in Argentina, 100 in Brazil, 44 in Chile, 24 in Uruguay, and 12 in Peru. Paraguay is erecting 10 and Bolivia 7 stations; Colombia has 2 stations in operation and others in course of erection, and Ecuador has 4 in prospect. Thus ships near the coast, provided with wireless apparatus, can be constantly in communication with the land. A station is probably working also at Juan Fernandez, where German cruisers are known to have lain for several days; this station is within the range of the powerful station at Punta Arenas, on the Strait of Magellan.

The Colombian Minister for Foreign Affairs has given orders for the removal of the high-power wireless station at Cartagena.

Telegraphy at the Front.—According to the official "Eye-witness" at the Front, the Army Signal Headquarter Office is the nerve centre of the Army in the Field, receiving messages from all quarters, including the base and England, by telegraph, telephone, wireless telegraphy and motor-cyclist. About 3,000 messages are handled daily, and both the Wheatstone high-speed apparatus and duplex telegraphy are in operation.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—The last issue to hand (for June) of *La Electricidad y la Maquinaria* states that by the end of that month the new conditions of tender submission drafted by the municipality of Rosario for a lighting concession would be ready. The lighting may be by electricity or gas. Six tenders were submitted for the previous submission, but all were held to be inacceptable. It was thought that only one tender would be sent in on this latter occasion.

Australia.—SYDNEY.—February 15th, 1915. Potentiometer, for the Municipal Council. Specifications (10s. 6d.) from the City Electrical Engineer, Town Hall.—*A. Mining Standard.*

ADELAIDE.—January 20th. Telephone material, fuse, &c., for Postmaster-General. See "Official Notices" to-day.

January 27th. Accumulators, and power board, for Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—January 6th. Six 100-K.V.A. single-phase transformers. 7,230 yards of single conductor lead-covered cable, for the City Council. See "Official Notices" to-day.

Dundalk.—December 21st. G.N. Railway (Ireland). Electric motors and accessories, sub-station switchboard, hard drawn copper wire, bitumen wires. See "Official Notices" December 4th.

Glasgow.—December 12th. The Corporation invites offers for the installation of electric lighting, telephones, bells and fire-alarms, required at Robroyston Hospital. Mr. W. W. Lackie.

Greece.—ATHENS.—The Hellenic Direction of Telegraphs calls for tenders for supplies of 1½, 2 and 3-millimetre brass wire, also for phosphor-bronze wire and for 34-millimetre galvanised-iron wire. Particulars from, and offers direct to, Ministry of Communications (Direction of Telegraphs), Athens.

Hornsey.—December 29th. E.H.T. switchgear and E.H.T. three-core cable, for the Borough Electricity Works. See "Official Notices" December 4th.

January 2nd. L.T. switchgear, &c., for the T.C. See "Official Notices" to-day.

Hull.—December 14th. Electrical goods, for the Board of Guardians. Mr. R. H. Winter, Clerk, St. Mary's Chambers.

Johannesburg.—January 5th, 1915. Materials, renewals, &c., for tramway equipments, for Municipal Council.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" to-day.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-KW. turbo-alternators complete. See "Official Notices" November 13th.

December 21st. Corporation. Three reactance coils, for generating station. See "Official Notices" December 4th.

Nottingham.—December 28th. Electric motor and laundry plant for the B. G. Mr. J. A. Battersby, clerk, Shakespeare Street.

Spain.—December 20th. The municipal authorities of Pino de Campo (province of Palencia). Tenders for the concession for the electric lighting of the town during a period of five years.

Torpoint.—Public lighting, for the U.D.C. Mr. R. H. Beaumont, Council offices.

Walthamstow.—December 23rd. U.D.C. 1,500-KW. turbo-alternator, 600-KW. triple-expansion engine and dynamo 1,000-KW. rotary or motor-converter. See "Official Notices" December 4th.

Warrington.—December 18th. Education Committee. Electric bell installation at the Oakwood Avenue Council School. Specifications, &c. (half-a-guinea, returnable), from Mr. J. Moore Murray, Education Office.

Winchester.—December 17th. Corporation. One 500-KW. D.C. turbo-generator, with condensing plant, pipework, &c. See "Official Notices" November 27th.

CLOSED.

Blyth.—Messrs. Johnson & Phillips, Ltd., have received an order from the Blyth Shipbuilding and Dry Docks Co. for the supply and laying of three-core low-tension, paper-insulated, lead-covered, steel tape armoured cables for power purposes in connection with their dock extension.

Bradford.—The Electricity Committee has accepted the offer of the Sturtevant Engineering Co., Ltd., to supply an air filter for the turbo-alternators, at £331; also the offer of Messrs. Clough, Smith & Co. to erect an overhead transmission line between Frizinghall and Esholt.

Bristol.—The Electrical Committee has entered into a contract with the East Bristol Collieries, Ltd., for the supply of 26,000 tons of coal to the Avonbank Works during the 12 months ending September 30th next.

Cleckheaton.—The Cleckheaton Co-operative Society has accepted the tender of Messrs. F. W. Birkett & Sons, Ltd., for the carrying out of electricians' work at the new branch store of the Society at March.

Dartford.—The E.L. Committee has recommended the acceptance of the following tenders in connection with the extension of the electricity works:—

Wm. Press & Sons.—Laying 14-in. cast-iron pipe line, £562.
Babcock & Wilcox, Ltd.—Pipework, £490.
Johnson & Phillips, Ltd.—Switchgear, £332.

With regard to the proposal to hire temporary plant, the Council has been recommended to accept the offer of Messrs. Fraser and Chalmers, Ltd., for a turbine.

Dewsbury.—The Electricity and Tramways Committee has accepted the following tenders:—

Union Cable Co., Ltd.—Electric cable.
A. Hirst & Son.—Spare armature.

Glasgow.—The Tramways Committee recommends acceptance of tenders from the following:—

Section pillar castings.—James Allen, Senr., & Son, Ltd.
Scrap lead.—Pegler Bros. & Co., Ltd.
" copper.—P. & W. MacLellan, Ltd.
" armature coils and vulcanised cable.—Shearer Bros.
" zinc and cells.—R. M. Easdale & Co.
" lead-covered cable.—Ballardie, Holden & Co.
" rubber.—City Waste Rubber Co.
Special trackwork.—Titan Trackwork Co., Ltd.

Hereford.—The City Council has accepted the tender of Messrs. Harding Bros., Ltd., to wire houses in Mostyn Street, at 11s. 6d. per house.

Hornsey.—The B.C. has accepted the tender of Mr. H. Pickrill, at £3,779, for erecting an electricity sub-station at Muswell Hill.

Llandudno.—The U.D.C. has accepted the tender of Messrs. Henleys, Ltd., for electric cable, at £788 (11s. 9d. per yard).

London.—STEPNEY.—The B.C. Electricity Committee reports the purchase of 4,300 tons of coal for the electricity undertaking, in lots of 100 to 500 tons, at prices ranging from 10s. 6d. to 14s. 9d. per ton.

POPLAR.—As the B.C.'s contract with the Western Electric Co., Ltd., for cable expired in October last, and in view of the fall in price in copper, the engineer has entered into a further contract over two years with the company at a fixed price for copper of £52 10s. per ton, with rise and fall in price of lead; he has also obtained 10 tons of copper from Messrs. Siemens Bros. at the same price. The Committee has approved the action of the engineer, and has authorised him to place an order, as occasion offers, for a further quantity of 30 tons of copper at the most favourable price below £60 per ton.

WOOLWICH.—The following tenders have been accepted by the Electricity Committee:—

Cole, Marchant & Morley, Ltd.—Installation of an exhaust steam heater, £75.
Heenan & Froude, Ltd.—Rotary air filter and air trunking, £262.
Ferguson, Pailin & Co.—Erection of switchboard, £18.

Macclesfield.—Councillor W. R. Brown, A.M.I.E.E., has received the contract for installing electric light throughout the Macclesfield Arms Hotel. Mr. Brown has also in hand a contract for effecting improvements in the lighting and ventilation of the Masonic Room.

Morley.—The T.C. has accepted the tender of the Howley Park Coal and Cannel Co. for a year's supply of coal for the Electricity Works.

Normanton.—The Joint Hospital Committee has accepted the tenders of Messrs. C. J. Cox & Co. as follows: Replating storage battery, £149; voltmeter, £3 10s.; extension of cables, £11.

Salford.—The T.C. has accepted the offer of Messrs. T. Mitchell & Sons, Ltd., to purchase a motor-driven boiler feed pump at the electricity station for £40.

Sheffield.—The Electric Supply Committee has accepted the quotation of Messrs. A. Reyrolle & Co., Ltd., at £94 10s., for the supply of 24 overload relays for sub-station switchgear; also the tender of Messrs. Longbottom & Co. for a supply of coal to the generating station. The Tramways Committee has accepted the offer of Messrs. Durham, Churchill & Co. to supply a 45-H.P. 3-ton motor chassis for £650.

The City Council is being recommended to enter into negotiations for extending the present contract with Messrs. Willans & Robinson, Ltd., for a turbo-alternator, subject to a satisfactory price being arranged. The Electric Supply Committee proposes to instruct the general manager to place an order for 100 tons of electrolytic copper wire bars to be made up into cables.

Ship Lighting.—The G.E. Co. have again been successful in securing a 12 months' contract for the supply of Osram ship-lighting lamps from the Cunard Steamship Co., Ltd.

Southampton.—The Harbour Board has accepted the tender of Messrs. Stothert & Pitt, Ltd., for electric controllers for cranes.

Stretford.—The tender of Messrs. Veritys, Ltd., has been accepted by the Electricity Committee, at £55, for the supply of a 15-H.P. motor.

Sunderland.—The T.C. on Wednesday accepted the following tenders:—

Everett, Edgcumbe & Co., Ltd.—Recording voltmeters.
J. W. Thompson & Co.—Coal-chutes.
Phœnix Dynamo Manufacturing Co., Ltd.—Control panel for sub-station feeder booster.
Underfeed Stoker Co., Ltd.—Underfeed stoker.

Torquay.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a duplicate set of turbines and condensing plant, at the following prices:—

Turbines, £3,837 (increase of 7·3 per cent. on previous price); condensing plant, £1,247 (increase of £45); rotary converter, £1,168.

Tunbridge Wells.—The tender of the Western Electric Co., Ltd., has been recommended for acceptance for a triennial supply of cables. It is proposed to purchase from the Western Electric Co. 30 tons of copper at about £53 per ton.

Wakefield.—The Electricity Committee has accepted the following tenders:—

C.I. floor plates.—E. Green & Son, £23 15s.
Coal.—Victoria Coal and Coke Co.

York.—The City Council has decided to accept the tender of Mr. J. W. Pease, of Doncaster, for the construction of the tramway track to Hull Road, at £22,203.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, December 11th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Northampton Polytechnic Institute.—Friday, December 11th. At 8 p.m. At St. John Street, Clerkenwell, E.C. Annual prize distribution by the Right Hon. Lord Moulton of Bank, F.R.S.

Association of Engineers-in-Charge.—Saturday, December 12th. Social and Dance.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 12th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, December 12th. At 7.15 p.m. At Newcastle-on-Tyne. Paper on "Stability," by Mr. P. Y. Brimblecombe.

Friday, December 18th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Junior Institution of Engineers.—Monday, December 14th. At 8 p.m. At 39, Victoria Street, S.W. Presidential address by the Marquis of Graham on "The War and Engineering."

Institution of Electrical Engineers (Newcastle Local Section).—Monday, December 14th. At 7.30 p.m. At the Mining Institute. Paper on "Cables," by Mr. C. J. Beaver.

Manchester Local Section.—Tuesday, December 15th. At 7.30 p.m. At Engineers' Club, Albert Square. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

Yorkshire Local Section.—Thursday, December 17th. At 7.15 p.m. At Hotel Metropole, Leeds. Special General Meeting to Welcome the President, Sir John Snell.

Birmingham Local Section.—Wednesday, December 16th. At 7.30 p.m. At the University, Edmund Street. Paper by Mr. E. B. Wedmore.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 14th, at 8 p.m. At Storey's Gate, S.W. Paper on "Conditions Governing the Power of the Petrol Engine." By Mr. C. B. Dicksee.

Association of Supervising Electricians.—Tuesday, December 15th. At St. Bride's Institute, Bride Lane, E.C. Paper on "Wiring Systems," by Messrs. C. R. Bates and C. J. Banister.

Nottingham Society of Engineers.—Wednesday, December 16th. At 8 p.m. At "Welbeck" Hotel, Milton Street. Lecture on "Mechanical Stoking," by Mr. E. Kenyon.

Wireless Society of London.—Friday, December 18th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Lecture on "The High-Frequency Resistance of Wires and Coils," by Prof. G. W. Osborn Howe, D.Sc.

Association of Mining Electrical Engineers.—Saturday, December 19th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Experiences of Surface Earthing in Scottish Mines," by Mr. P. S. Glover.

ABOUT A PERSONAL APOLOGY.

WITH reference to the Leaderette appearing on page 775 of this issue regarding the circulation of "Apology" advertisement postcards, we shall be grateful if readers who received such cards will, if they still have them in their possession, kindly forward them to us.

NOTES.

Christmas Holidays.—Owing to the Christmas holidays and the consequent closing of the ELECTRICAL REVIEW offices on Friday and Saturday, December 25th and 26th, our issue for the week after next will appear on Wednesday morning, December 23rd. Will readers, contributors and advertisers kindly take note of the following times for sending in matter, &c.:—

Editorial: All communications for the Editorial department, except the latest items of special news, should be sent in so that we receive them by Monday morning, December 21st.

Advertisements: The Advertisement department announces elsewhere in to-day's pages that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than Friday morning, 18th inst. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, the 22nd inst.

Foreign Trade.—THE NOVEMBER FIGURES.—The following are the electrical and machinery figures given in the official returns for November:—

IMPORTS.	*Month of November.* £	*Inc. or dec.* £	*Eleven months,* 1914. £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	62,825	−91,165	1,152,017	−279,754
Machinery	417,364	−145,648	6,160,153	−504,009
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	235,943	−701,112	2,833,330	−2,224,877
Machinery ...	1,739,633	−1,569,633	29,878,937	−4,191,189

British Electrical Export Trade.—At the next meeting of the Sales Managers' Association, which is called for Thursday, 17th inst., at the Holborn Restaurant, Mr. H. Scholey will open a discussion on "The Position of the British Electrical Industry and Methods of Extension in the Markets of the World." Readers who desire to be present should communicate with the hon. sec. of the Association, Mr. F. R. Jones, Sardinia House, Kingsway, London, W.C.

Electric Gear Changing.—According to the *Motor*, some data as to the current required by an electrically-controlled gear box (for motor-car work) are now available. In a recent American test energy was supplied by a 12-volt 80-ampere-hour battery, which was not recharged during the period of test, and 134,490 gear changes were made, representing a hundred changes a day for four years, so that the gear in the matter of energy consumed is a very economical one.

Municipal Borrowing in Canada.—A correspondent at Ottawa writes:—"The Canadian municipalities, who have been unable to borrow money for local improvements for the last year or so in London, and whose works for improvement have consequently been at a standstill, will soon be forced to borrow in the New York money market instead of in London. This is not so strange after all, for New York is, or should be, the natural source to which Canadians should look for funds, at least during the present crisis. There is utterly no prospect of our municipalities getting funds from London for a long time to come. There is no other source than New York for our towns to obtain money to carry on and extend much-needed local improvements and to meet pressing obligations. In borrowing in New York decidedly more attractive rates of interest have been offered and accepted than in London. Some of the provinces and municipalities have been trying to dispose of debentures in the home market, but this is limited, and sales proceed but slowly. The money for future improvements must come from a foreign market, which has no sentimental feelings on account of our connection with the British Empire, as London has had, at a heavy rate of interest. But the money must be obtained at any cost by our rapidly-growing towns and cities and expensive Provinces, and it is good that the money so badly needed may be obtained, although the outlook of being forced to, obligate ourselves in a foreign market is not pleasing on practical as well as sentimental, grounds."

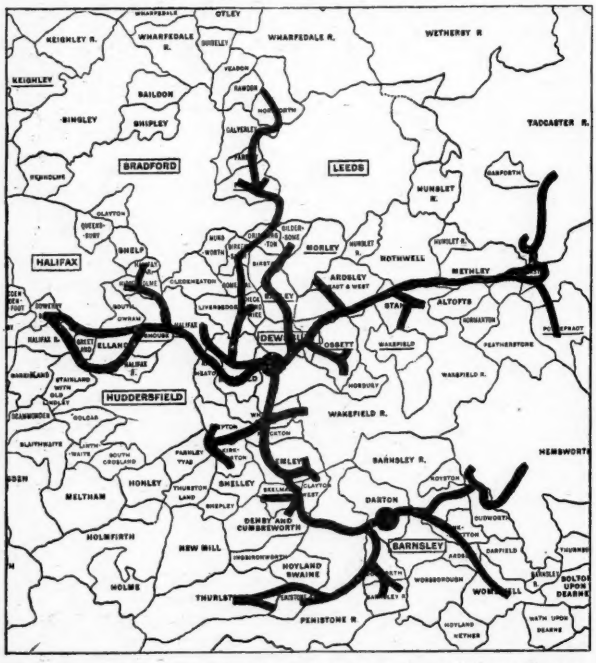
Edison Works Destroyed.—As we go to press we learn with regret that the entire plant of the Edison Company, New Jersey, has been destroyed by fire. The loss is estimated at £1,000,000 sterling.

Fire Risks.—Under the new *régime* it is a common thing to see the brilliancy of electric lamps in shops toned down by the use of tissue paper or other highly combustible screens. The danger arising from this practice cannot be too seriously impressed upon the users. Although no harm may occur so long as the shade is not in contact with the glass, it is courting disaster to adopt this method of reducing the illumination, especially at this season when shops and shop windows are being dressed with highly inflammable goods. Let us not forget the terrible fire at Messrs. Arding & Hobbs's shop in 1909; one such experience is enough.

Yorkshire Electric Power Co.'s Supply.—Following an unsuccessful application last year, this company is promoting a Bill in Parliament to remove various restrictions imposed on its supply in certain districts.

The company is authorised to supply electricity over a large part of the West Riding, and it has developed in districts near large towns a supply of electricity for power purposes which is widely used by collieries, mills and factories. In addition various districts depend on the company for electric light, but there are other more rural ones in which no lighting supply may be given by the company even though the mains pass through the districts, and this anomaly it is proposed to remove. The proposals have received a considerable measure of support.

At present the company supplies in bulk the following undertakings:—Ardsley, Birstall, Brighouse, Calverley, Castleford,



Darton and district, Farsley, Gomersal, Goole and district, Greetland, Heckmondwike, Hipperholme, Horsforth, Liversedge, Mirfield, Ossett, Pontefract, Pudsey, Ravensthorpe, Rothwell and district, Sowerby Bridge, Whitwood, Wombwell and Worsborough. Of these undertakings, five are being worked by the local authorities, and five have been transferred by the local authorities who originally owned them to the Electrical Distribution of Yorkshire, Ltd.—a company formed in association with the Power Co. for the purpose of working E.L. undertakings in the West Riding.

We publish herewith a map showing the principal transmissions of the company, the spots representing power stations at Dewsbury and Darton. A supply is also being given to Goole and district from a power station just outside the Goole area.

Electricity in Agriculture.—Mr. J. E. Davidson, of the Pacific Power and Light Co., in a recent paper on "Extensions of Electric Service in Rural Communities," points out that a company cannot afford to supply electricity in a rural territory unless the estimated yearly revenue is equivalent to 50 per cent. of the cost of construction of the extension, including the usual overhead expenses.

Contracts should be closed before construction work is started, and be for periods of 10 to 20 years.

The author recommends rates made up of a fixed charge based on the maximum peak demand for a season, with an additional meter charge based on the peak demand per month.

Irrigation pumping can be successful if a large installation is made to serve several land tracts in rotation; data from a number of installations of from 2 H.P. to 20 H.P. show an average cost of energy per acre irrigated of $6.6 a year. By installing motors for pumping and operating farm machinery in the Yakima Valley, Washington, the Pacific Power and Light Co. has provided itself with a load which brings in $50 per H.P.-year. The Noblesville (Ind.) Heat, Light and Power Co. is offering farmers the electric drive for filling their silos with ensilage. Using a hired steam traction engine drive, the total cost amounts to some $12.5 a day, and time is lost in getting up steam in the morning. The company hires out a 15-H.P. motor and transformers mounted on a truck, at $5 a day, inclusive of the cost of energy, and this portable power plant has been used for the general driving of machinery. The average energy required per ton is 1·17 KW.-hours.

Among the 150 farm-owners in South-Western Ontario receiving electric service from the Hydro-Electric Power Commission are several dairymen. The accompanying data were collected from

	Percentage of total KW.-hours.	Cost.	Unit cost.
Pumping water, four hours a day.	28·3	$17.75	$0.0011 per barrel.
Milking, 421 times—30 cows	23·7	14.98	0.0012 per cow per milking.
Separating cream, 316 times	8·2	5.20	0·011 per hour.
Heating water, 2,420 gals....	29·0	18·35	0.007 per gal.
Lighting	10·8	6.74	
Total	100·0	$63.02	

the records of one of these dairy customers for the period from March 16th to October 18th, 1913.—*Electrical World.*

Institution and Lecture Notes.—Royal Institution.—Commencing on December 29th, Prof. C. V. Boys will give a course of six experimentally illustrated lectures adapted to a juvenile auditory on "Science in the Home."

Institution of Municipal Engineers.—The report of the Council for the year ending June 30th, 1914, shows that the membership at that date numbered 895, a decrease of 20. The revenue was £917, and the expenditure £881, leaving a balance of £36. The accumulated balance was £392.

Association of Mining Electrical Engineers.—At the opening meeting for the session of the EAST OF SCOTLAND BRANCH, at Cowdenbeath, Fife, in his presidential address, Mr. N. A. Wilkie, Bowhill, dealt with the various accidents which during the year had occurred in connection with the electrical side of mining.

Institution of Civil Engineers.—On Tuesday a paper on "Concreting in Freezing Weather, and the Effect of Frost upon Concrete," was read by Mr. John Hammersley-Heenan, who stated that the freezing of concrete would not damage it if it had at first had a chance to set under favourable conditions for about two days. It was alternate freezing and thawing during the process of setting that caused the damage. To meet the foregoing conditions, when carrying out concrete work in winter, it was necessary to devise means of mixing the concrete with materials freed of frost, placing it in the forms before it had commenced to freeze, and then protecting and keeping it warm for about two days. After that it might be allowed to freeze without fear of its being damaged.

Institution of Electrical Engineers.—A meeting of the SCOTTISH LOCAL SECTION was held at Glasgow on Tuesday, December 9th, Mr. Lowson, chairman, presiding, when Mr. J. S. Nicholson read a paper on "The Magnetisation of Iron at High Flux Density with Alternating Current." A discussion followed.

Copper.—Messrs. H. R. Merton's statistical circular shows European supplies still well sustained. The figure given is necessarily relative, as the stocks at Hamburg and Bremen must be constantly fluctuating, and will, in any case, not be available for useful purposes for some time, while of those at Havre only an estimate is available. Subtracting these quantities, £9,509, we find stocks in England and afloat at 26,240 tons against 21,493 tons at the end of last November.

American supplies were under the average for the 12 months preceding August, Spanish low, Chile shipments the same, and Australian rather below the average. Australia seems inclined to pick up on the shipments, present quantities afloat being 3,900 tons, or considerably over the normal month's supply. December is, in the ordinary course, a much heavier month for supplies than November.

Fatalities.—BARNSLEY.—A second victim of a tramway accident at Barnsley died on Friday. At the inquest on the body of Miss Gladys Fitzgerald (21), of Monk Bretton, it was decided that her death was due to the accident caused by the carelessness of the driver and the conductor. The jury agreed with the coroner's suggestion that the driver should not leave a car without informing the conductor, and that the latter should not release the brakes until he saw that his driver was on board. The tramway company promised to frame rules in accordance with the jury's rider.

PORTSMOUTH.—A local paper says that one of the staff of the Portsmouth electricity works met his death while engaged at the switchboard on December 1st.

DEVONPORT.—At the inquest into the death of two labourers through a Devonport tramcar accident, the Mayor attended, and said that he "wished to express deepest sympathy with the two men who had so suddenly been killed."—(*Western Morning News*, December 1st.) A third death has occurred, and at the resumed inquest the jury found that the deaths were due to the car overturning, through faulty brakes, and expressed the opinion that the cars at times were greatly overcrowded.

Motor Repair Wagons.—The *Standard* states that six repair wagons have been attached to the transport department of the Australian Expeditionary Force, each of which weighs about seven tons, and cost, approximately, £5,000. All of them have collapsible sides, which may be supported on metal uprights, so that in case of need the ordinary floor space can be at least trebled. There are lathes, drills, milling machines—all electrically driven by a dynamo deriving its energy from the propelling engine—and there is a forge in each as well. In addition to the driving stuff, the workshop cars will each carry six qualified turners and fitters.

Late Legal.—ATTORNEY-GENERAL *v.* ILFORD URBAN DISTRICT COUNCIL.—This action, which was brought at the relation of the Ilford Gas Co. to restrain the Council from giving an alleged undue preference to those who used electricity to the exclusion of gas, and from supplying lamps, fittings, &c., was mentioned to Mr. Justice Sargant in the Chancery Division on Wednesday, December 9th.

Mr. Martelli, K.C., representing the Council, said he had to apply that the case should stand over until next sittings. If the case was to go on it would be necessary to call as a witness the treasurer to the Council to speak to certain accounts. He was on active service, and as yet it had been impossible to get at him. If necessary, however, it was thought that they would be able to communicate with him before the end of the year. The more important reason was that certain proposals had been made by the plaintiffs to the defendants which were under consideration, but it was not possible to call a meeting that week. Moreover, the matter required great consideration, and the exact terms of any agreement would have to be very carefully prepared. It was a most important case for the Council.

Mr. Mark Romer, K.C., for the plaintiffs, had no objection to the case standing over until next sittings if his Lordship could see his way to retain it before him.

Mr. Justice Sargant thought he ought to do so as briefs to counsel had been delivered. He would take it early next sittings.

It was ultimately arranged that the case should be in the list for hearing on January 12th next.

Appointments Vacant.—Switchboard attendants (30s.), for Luton electricity works; traffic superintendent for Yorkshire (West Riding) Electric Tramways Co., Wakefield; mains engineer (£4), for Walsall electric supply department; generating engineer, to take charge of a 4,000-KW. generating station; cable jointer (£2 2s.), for Neath R.D.C.; switchboard attendant (30s.), for Newport Corporation; shift engineer (28s.) for Morley Corporation; switchboard attendant for Heywood (20s.). Particulars are given in our advertisement pages.

The Conquest of the International Electrical Market.—Under the above heading, the *Revista Tecnica d'Elettricità* makes the following comments on the chances of success of the various competing countries seeking to secure Germany's foreign trade:—

Countries having a solvently organised industry are now seeking with all their forces to conquer the international market formerly dominated by Germany in every field of industry and commerce England, especially, has applied herself with all her energy to the preparation of a plan of operations which shall secure her establishment in many of the markets formerly the undisputed domain of Germany. With a view to guiding and helping English efforts in this direction, the Board of Trade has published a monograph containing statistics of the importations of the various countries of the world, on the basis of the most recent Consular reports. From these statistics it appears that in the case of 18 separate countries the German and Austrian exportations of electrical machines, motors and transformers amounted in 1912 to 64 million francs, while those of England to the same countries in the same period did not exceed 38 millions. It should be noted that among these 18 countries are two where England might expect to enjoy an unquestioned preponderance—these are the South African Republic and Australia. South Africa alone last year acquired 350 million francs' worth of electrical material of all kinds, which were drawn from the following countries in the proportions named:—70 per cent. from Germany, 20 per cent. from England, and 10 per cent. from the United States.

But the English are beginning to recognise that the conquest of foreign markets will not be so easy and agreeable an undertaking as it appeared at first sight; they will have, indeed, absolutely to abandon commercial methods which they formerly followed with a perseverance worthy of a better cause, in order to pursue those methods which have given such good results in the hands of the Germans. The English, however, have never understood the necessity of publishing catalogues in the tongues of the natives of foreign countries, and have always looked upon the sending of representatives, travellers and experts as a useless labour; nor have they troubled to consult the tastes or the exigencies of their clients, but have always thought it possible to impose English tastes and ideas everywhere.

The obstinacy with which English manufacturers have persisted in following their old commercial politics has brought about the incredible result that even in England itself they find themselves beaten by German industry. We confine ourselves to citing two examples only, to which we called our readers' attention a short time ago. These are arc-lamp carbons and metal-filament lamps, for both of which England is tributary to German works for its whole requirements.

England has consequently an exceedingly difficult part to play, for she has both to organise an industry and a commerce which are not improvised in 24 hours, the more so as this organisation presupposes a complete revolution in methods and systems which have prevailed for, maybe, more than a century.

It is possible that the United States in this special regard will find themselves in better conditions. Our [Italian] industry is of very modest importance, but we believe that, in this respect, we enjoy privileged conditions, be it owing to the greater adaptability of our genius, or that we have no traditions to preserve or change, and can more easily adapt German organisation to our industrial and commercial methods, even where they are not compatible with our natural bent.

The struggle which England has launched into is in any case very interesting, and we purpose following it with every attention. As the international organisation of information possessed by England is certainly the best that exists, after the German, of course, we shall make it our duty to peruse and extract from the reports of the English Consular agents such data and elements as may be of use to the manufacturers of our own country. Unluckily, from this point of view, we are much worse served, for our Consular officials occupy themselves almost exclusively with political questions, and possess neither the competency nor industrial and commercial education necessary. Therefore, not being able to make fire with our own wood, we are compelled to use that of others.

An Edinburgh Shock Claim.—The Court of Session disposed of an application, under the Emergency Powers (Courts) Act, in the action by a Fife miner against the lessee of a picture house in Lochgelly, in which the pursuer sought damages for injuries sustained by his son, arising from the fixing of an electric wire which the defender attached to the snib of one of the windows of his picture-house. The boy touched the snib and received a severe shock. At a previous hearing the defender maintained that the action ought to be dismissed, as the boy was a trespasser, but the Court sent the action to the Sheriff Court for proof, and gave pursuer expenses. The pursuer now asked for leave to proceed with diligence to recover £34 and expenses. For the defender delay was asked, as on account of the war the people of Lochgelly had no money to spend in going to picture palaces, and the effect was that the defender's business had practically ceased to exist. The operation of the decree was suspended for six weeks.

Re Electric Vehicles.—Referring to our article on this subject in last week's issue, MR. F. A. YERBURY, of Westminster, writes saying:—"I would draw your attention to one point which, to my knowledge, has had an important bearing on the sale of electric trucks on the other side of the Atlantic. In some cities the local electric supply company have gone into the truck business, and sell these vehicles with an upkeep guarantee. If I remember rightly, the B.C. Electric Railway Co., in Vancouver, charge about $25 a month for garaging, battery charging, cleaning and guaranteeing a 3-ton truck to be ready for use, in first-class order, every morning. If for any reason the truck gets out of order, the hirer is provided with another truck in first-class running shape. This, of course, makes a very considerable difference to the business, as it costs at least $25 a month in Vancouver to have an ordinary petrol truck stored, and cleaned, without any guarantee as to its running condition. When this sort of thing is common in England there is no doubt the electric truck will make some headway."

Engineering Societies in Manchester.—Owing to the war, which has absorbed the energies of many who are interested in the co-operative scheme for providing a common meeting room and library for the engineering and technological societies in Manchester, it has been decided to defer the matter to a more convenient season.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Wednesday last week the wedding took place at St. Margaret's Church, Manchester, of MR. G. A. ROBERTS, assistant manager and engineer of the Doncaster Corporation electricity and tramways department, and Miss Henrietta A. Owen, daughter of the (late) Mr. and Mrs. Owen, of Woodlands, Lawton.

MR. JAMES JONES, of Heywood, has been appointed shift engineer at the Stretford generating station in the place of MR. J. W. THOMAS, resigned.

MR. C. W. MARSLAND has resigned his appointment as shift engineer at the Eccles electricity works.

On Saturday last, MR. F. RILEY, station superintendent to the Rawtenstall Corporation, was the recipient of an oak timepiece, subscribed for by the staff and employés, on the occasion of his leaving to take up the post of resident engineer at the new Whalley Asylum. Mr. Stewart, the borough electrical engineer, made the presentation.

General.—The Electric Lighting Committee of the Stoke Newington Borough Council has appointed MR. W. H. SAVERY, J.P., C.C., chairman for the ninth successive year.

ALDERMAN KILEY has been appointed chairman of the Stepney B.C. Electricity Supply Committee.

The marriage took place at Maxwell Manse, Glasgow, on November 28th, of MR. THOS. PATON, electrical engineer, of Glasgow, and Miss Jean Sample, second daughter of Mr. John Sample, of Berwick-on-Tweed.

At Leigh, COUNCILLOR DOBB has been appointed chairman of the Tramways and Electricity Committee, and COUNCILLOR PENNINGTON vice-chairman.

COUNCILLOR E. CHAPMAN has been appointed chairman of the Crewe Electric Lighting Committee.

The marriage took place last week of MR. SMITH MORTON, electrical engineer, of Cononley, near Skipton, and Miss Eva Maude, youngest daughter of Mr. R. C. Maude, of York.

Wills.—MR. EDWARD RILEY, a director of the Windsor Electrical Installation Co., Ltd., left £117,774 gross.

NEW COMPANIES REGISTERED.

All-British Electrical Co., Ltd. (138,488).—This company was registered on December 3rd, with a capital of £10,000 in £1 shares (5,000 pref.), to carry on the business of manufacturers, exporters and importers of and wholesale and retail dealers in electrical fittings, lamps and other materials and goods, etc., and to adopt an agreement with Ben Hammond. The subscribers (with one share each) are: R. Macgillivray, 52, Arlington Road, N.W., gent.; E. C. Tonkin, 9, Members Mansions, Westminster, S.W., clerk. Private company. The number of directors is not to be less than three or more than five; the first are C. F. Smith, B. Hammond and N. Dickin. Remuneration, £100 each per annum and 10 per cent. of the distributed profits divided between them. Registered office: 36, Victoria Street, S.W.

Carville Site and Power Co., Ltd. (138,489).—This company was registered on December 3rd, with a capital of £10,000 in £1 shares, to take over from the Newcastle-upon-Tyne Electric Supply Co., Ltd., a piece of freehold land at Carville, Northumberland, to erect thereon a station for generating electrical energy suitable for distribution and sale, to erect further generating stations in any place where the company may think fit, to carry on the business of suppliers of electricity, etc. The subscribers (with one share each) are: T. Jameson, 6, Warrington Road, Newcastle-on-Tyne, cashier; W. H. Golding, 23, Heaton Grove, Newcastle-on-Tyne, company secretary. Private company. The number of directors is not to be less than two or more than five; the first are John Theodore Merz, John H. Armstrong, and Robert P. Sloan. Remuneration as fixed by the company. Registered office: Royal Exchange Buildings, Newcastle-on-Tyne.

Coniston and District Electric Supply Co., Ltd. (138,478).—This company was registered on December 2nd, with a capital of £2,000 in £1 shares, to carry on at Coniston and adjoining district the business of an electric light and supply company in all its branches. The subscribers (with one share each) are: C. H. Best, 72, Market Street, Bradford, incorporated accountant; C. Pullan, 80, King's Arcade, Bradford, electrical engineer; F. W. Poole, Ulverston, solicitor. Private company. The number of directors is not to be less than three or more than five; the first are to be appointed by the subscribers. Where there are only three directors, two of such directors shall be the holders of ordinary shares and one the holder of preference shares; or where there are five directors, three shall be holders of ordinary shares and two the holders of preference shares. Qualification £25. Remuneration as fixed by the company. Solicitor, F. W. Poole, Ulverston.

Wezdon Lamp Co., Ltd. (138,484).—This company was registered on December 2nd, with a capital of £3,000 in £1 shares (2,000 pref.), to take over the business of dealers in electric lamps carried on by J. Agerup at Vulcan House, 56, Ludgate Hill, E.C., as the "Wezdon Lamp Co." The subscribers (with 1,000 shares each) are: W. L. Anspach, 9, Palmeira Avenue, Hove, Sussex, gent.; J. Agerup, 56, Ludgate Hill, E.C., merchant. Private company. The number of directors is not to be less than two or more than three; the first are W. L. Anspach (chairman) and J. Agerup (both permanent, subject to holding £1,000 shares each). Qualification of ordinary directors, £100 shares. Remuneration (except managing director), 25 guineas per annum. Registered offices: Vulcan House, 56, Ludgate Hill, E.C.

Tredegars, Ltd. (138,475).—This company was registered on December 1st, with a capital of £10,500 in 10,000 pref. shares of £1 each and 10,000 ord. shares of 1s. each, to adopt an agreement with Sir Herbert H. Bartlett, Bt., and Perry & Co. (Bow), Ltd., for the acquisition of the business (consisting for the most part of the supply of electric fittings and electrical work for domestic purposes and the supply of decorative work and fittings of all kinds for private property), managed and controlled by the said company on behalf of the said Sir Herbert H. Bartlett, together with certain property held therewith. The subscribers (with one preference share each) are: H. A. Bartlett, 31, Albert Road, Regents Park, N.W., contractor; G. F. A. Norman, Carisbrook, Beechwood Avenue, Kew Gardens, S.W., manager. Private company. The number of directors is not to be less than two or more than five; the first are H. A. Bartlett and G. F. A. Norman. The said H. A. Bartlett is to be chairman and governing director, and may retain office so long as he holds 2,000 shares; but in the event of his ceasing to be a director, Perry & Co. (Bow), Ltd., shall have the right to nominate a director in his place, and such director is to be chairman and governing director. Registered office: 53, Victoria Street, Westminster.

Winco Manufacturing Co., Ltd. (138,464).—This company was registered on November 28th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of electrical torches and batteries and all kinds of apparatus, fittings and appliances used in connection with electricity, electricians, mechanical engineers and manufacturers, workers of and dealers in electricity, etc. The subscribers (with one share each) are: C. H. Lowe, 285, Balsall Heath Road, Birmingham, traveller; E. A. Harrison, 16, Claremont Road, Smethwick, clerk. Private company. Table "A" mainly applies. Solicitors, Cochrane & Co., Birmingham. Registered office: 107, Pershore Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Naylorgraph, Ltd.—Debenture dated 18th November, 1914, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital (if any), subject to prior debs. Holder, J. M. Hunt, Fairlawn, Park Road, Southborough.

Telephos Domestic and Street Lighting Co., Ltd.—Issues on various dates from 25th February to 28th October, 1914, of £3,500 debentures, part of a series of which particulars have already been filed.

Salford Electrical Instruments, Ltd. (112,599).—Capital, £20,000 in £1 shares (10,000 pref.). Return dated July 9th, 1914. All shares taken up; £10,000 paid; £10,000 considered as paid. Mortgages and charges: Nil.

New Phonopore Telephone Co. Ltd. (44,654).—Capital, £19,000 in £1 shares (9,000 ord. and 1,000 fndrs.). Return dated November 13th, 1914. 7,141 ord. and 1,000 fndrs. shares taken up. £1 per share called up on 6,741 ord. shares. £6,731 paid, leaving £10 in arrears; £1,400 considered as paid on 1,000 fndrs. and 400 ord. shares. Mortgages and charges £6,950.

CITY NOTES.

Callender's Share & Investment Trust, Ltd.

Mr. T. O. Callender (Chairman) presided at the second annual general meeting of the company at Hamilton House, E.C., on Dec. 3rd. The proceedings were purely formal, and the following report was adopted on the motion of the Chairman:—The earnings in respect of dividends and interest on investments up to the 31st August, 1914, amounted to £11,410. After paying all working expenses, and writing off £741 in respect of preliminary expenses and cost of debenture stock issue, the gross profit amounted to £16,124. From this has to be deducted interest on debenture stock £5,750, amount deposited with debenture stock trustees, being second annual payment in respect of redemption fund, £1,800, leaving a balance of £8,574, plus £2,617 brought forward, making £11,192. A dividend at the rate of 5 per cent. per annum, less income tax, will absorb £7,770, and there is transferred to reserve account £500, leaving to be carried forward £2,921. The redemption fund in the hands of the trustees now amounts to £3,694.

The directors report that the receipts in respect of dividends and interest due from the various undertakings in which the company holds an interest continue to be satisfactory, and they have every reason to believe that the sums so received will be increased in the future as these companies extend their areas and develop their earning powers.

The Zurich Bank for Electrical Undertakings.

The report of the Bank fur Elektrische Unternehungen of Zurich, which is probably the largest investment enterprise of its kind, states that the general situation of business until the close of the financial year, which ended on June 30th, 1914, was as unsatisfactory as in the preceding year, as great pressure was imposed on the business world by the condition of war in the Balkans, the threatening danger of hostilities between Turkey and Greece, the protracted revolution in Mexico, and the economic crisis in South America. Since then these apprehensions have been surpassed by the outbreak of the war in Europe, the consequences of which cannot be foreseen. On the return of peaceful conditions the introduction of electrical working on further railways will be of special importance for the future development of electrical engineering. In Switzerland the electrification of the St. Gothard Railway had been decided upon, and the change to electrical operation on State railways and suburban lines was also making progress in Italy and Germany, whilst other countries were exercising a certain reserve for the time being. The realisation of many schemes in this department and in other branches would be rendered impossible through the war for a long time to come. Further noteworthy results had been achieved in the transmission of electrical energy over long distances, and in particular the employment of pressures up to 100,000 volts had now also found application in Europe. These achievements were calculated to accelerate the business of distributing current after the conclusion of peace. Notwithstanding many difficult circumstances, most of the works associated with the Bank had made satisfactory progress down to the commencement of the war. The unfavourable situation of trade in general had hampered the consumption of energy for industrial purposes, but it was possible to equalise matters by reducing the cost of production and the further cultivation of business. Although certain works were directly situated in places covered by the war area, nothing was yet known of any material damage having been caused, but a number of supply works had experienced a decline in consumption owing to the restrictions in general business activity. The accounts show the following figures for the past two years:—

	1913-14.	1912-13.
Share capital	£3,000,000	£3,000,000
Loan capital	2,996,000	2,630,000
Gross receipts	513,000	443,000
Net profits and balance forward	330,000	287,000
Dividend, per cent.	10	10

Among the numerous investments referred to in the report and applying to different countries, attention may be directed to the Constantinople Syndicate of Brussels, which formed on June 30th, 1914, the Tramways et Electricité de Constantinople with a capital of £720,000 for the purpose of carrying out electrical undertakings in the Turkish capital. Electrical working on the tramways had been started and the Societié Ottomane d'Electricitié, which also belonged to the Constantinople Syndicate, had likewise commenced the supply of current. The report refers further to the Russian undertakings in which the Bank is interested, and mentions that the negotiations with the Finnish authorities in regard to the proposed utilisation of the water powers of the Vuoksen had been brought to a standstill in consequence of the war.

Aron Electricity Meter, Ltd.—A financial contemporary says that the directors announce that it is not their intention to pay an interim dividend on the preference shares.

Cape Electric Tramways, Ltd.

THE directors report that the profit and loss account for the year ending 30th June, 1914, shows a profit of £78,867, and after providing for debenture interest, redemption of debentures, and adding the balance brought forward, a net credit balance of £32,618 remains. The reserve fund has been credited with £8,000, leaving £24,618. The tramways in Cape Town carried 16,576,992 passengers, earning £155,472, as against 14,779,709 passengers, earning £144,222 in 1913. In Port Elizabeth 4,309,154 passengers were carried, earning £44,937, as against 4,155,711 passengers, earning £43,036 in 1913.

The labour troubles on the Rand, which resulted in a general strike in July, 1913, were followed by a recrudescence of the same trouble in January, 1914, and had a disadvantageous effect on the general business situation throughout South Africa, checking to a certain extent the otherwise satisfactory advance in revenue of the tramway systems in Cape Town and Port Elizabeth. In spite of these economic checks the receipts from the tramways show satisfactory advances during the year under review, but, owing to the increase in the cost of maintenance and operating charges, and to the provision for the income tax lately imposed by the Union Government, the net profit is less than that of the preceding year.

The additions to the rolling stock and to the power plant at Port Elizabeth have now been completed, and the new unit of power in Port Elizabeth is working most satisfactorily, and giving results of considerable economy in the consumption of fuel.

The prevalence of war throughout the greater part of the world, and more especially the rebellion now going on within South Africa, has created such a serious financial and trading outlook, both in that country and elsewhere, that the directors have decided to recommend the declaration of a dividend of only 2½ per cent. They have considered this a prudent course to adopt in view of the present condition of affairs generally.

The directors refer to the valuable services rendered by the local boards in Cape Town and Port Elizabeth, also by the general managers in Cape Town and Port Elizabeth, and the staffs under them.

Mr. J. A. Barkley, general manager of the Cape Town companies, reports that the total revenue was £155,472, and the expenditure £86,284, leaving a profit of £69,189. The figures for the previous year were: Total revenue £144,222, operating expenditure £77,859, gross profit £66,363.

Mr. W. H. Freemantle, general manager of the Port Elizabeth Electric Tramway Co., Ltd., reports that the new boilers and generating plant ordered at the commencement of the year are now in service, and are of ample power to do all that is required without assistance from the municipality, which has therefore been discontinued. The new boilers and generator have been in service since June 22nd and from the records available promise to considerably reduce the coal consumption, and will prove a most valuable addition to the company's power station plant. The total revenue amounted to £44,937. The traffic receipts show an increase of £2,134. The operating expenditure totals £27,716, or 61.678 per cent. of the revenue, and is an increase of £2,405 over last year. The passengers carried were 4,309,154 for 1914, against 4,155,711 for 1913, an increase of 153,443.

Hong Kong Tramway Co., Ltd.

MR. E. C. MORGAN presided recently over an extraordinary general meeting of the shareholders, held at the offices, 19, St. Swithin's Lane, when the resolution altering certain of the articles of association so that in future the meetings of the company shall be held in Hong Kong, which was passed at a meeting held on November 16th, was confirmed.

The CHAIRMAN said that the two following resolutions now had to be considered:—

1. That, in pursuance of Article 113, all the present members of the board of directors of the company be, and they are hereby, removed from the office of directors of the company, such removal to take effect from the time of the passing of this resolution. 2. That the Hon. Mr. David Landale (chairman), the Hon. Sir C. P. Chater, the Hon. Mr. E. Shellim, Dr. J. W. Noble, the Hon. Mr. Lau Chu Pak, Mr. Ho Tung, all of Victoria, in the Colony of Hong Kong, be, and they are hereby, appointed directors of the company, in place of the present board of directors.

He wished to say that as the present board desired to facilitate the arrangements for the transfer of the control, it was desirable for him on their behalf formally to "recommend" the new directors. In so doing, he wished to explain that he had no knowledge of the six gentlemen who had been nominated by the Hong Kong shareholders as the new board, and his "recommendation" must not be taken as implying any responsibility for the appointment, but he made the recommendation at the request of Messrs. Stephenson, Harwood & Co., the London solicitors acting for the Hong Kong shareholders, so as to avoid any question as to the legality of the appointment of the new directors, and to comply with the regulations of the company under Article 108 of the Articles of Association. Under the circumstances, he thought it would be best if Mr. Harwood and his friends would move and second the resolutions.

MR. HARWOOD then formally proposed the resolutions, which were seconded by MR MACKINTOSH, and they were carried, with the addition of the following words on the motion of the CHAIRMAN:—"And that such directors be on such removal paid their fees as directors on the scale authorised by the Articles up to the close of the financial year."

Globe Telegraph and Trust Co., Ltd.—Quarterly interim dividend of 2s. per share on the ordinary shares, income-tax already deducted.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the quarter to September 30th of 2s. 6d. per share, free of income-tax.

Melbourne Electric Supply Co., Ltd.—Final dividend of 5 per cent., making 10 per cent. for the year to August 31st, free of income-tax, on the consolidated ordinary stock.

Adelaide Electric Supply Co., Ltd.—Final dividend of 5 per cent., making 10 per cent. for the year to August 31st, together with a bonus of 2 per cent., both free of income-tax, on the ordinary shares.

International Light and Power Co., Ltd. — Dividend of 1½ per cent., less British income-tax, upon the preference shares for the quarter to December 31st.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Quarterly dividend of 1¾ per cent., or at the rate of 7 per cent. per annum, on the common shares.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared a dividend for the year ended December 31st of 2s. 9d. per share, less income-tax, on the 5½ per cent. cumulative first and 5½ per cent. cumulative second preference shares.

Alldays & Onions Pneumatic Engineering Co., Ltd.—The directors report that for the year ended August 1st, after providing for depreciation and all other outgoings, there is a net profit of £17,034, plus £17,443 brought forward. £3,590 is devoted to debenture interest, and, after paying the preference interest, a dividend and bonus of 10 per cent. on the ordinary shares is paid.

Continental.—ITALY.—A company has been formed at Rome with the title of the Società Anonima Telefonica Italiana Betulander, for the working of the Betulander telephone system in Italy and her Colonies and abroad. The capital is 200,000 lire, and the duration of the concern is limited to 25 years.

Under the style of Vestonese Elettrotecnica a company has been formed at Brescia, Italy, for the employment of hydraulic power and trading in electrical apparatus and machinery. The capital is 60,000 lire, in 600 shares of 100 lire each.

The Società Bresciana Autrotrasporti is a concern recently launched at Brescia, Italy, for the installation and working of provisional or permanent non-subsidised public services. Its capital is unlimited in 50 lire shares.

Manila Electric Railroad and Lighting Corporation.—The directors have declared a quarterly dividend of 1¾ per cent. on the common capital stock for the quarter ending December 31st.

Stothert & Pitt, Ltd.—A dividend of 5 per cent. (1s. per share), free of income-tax, is announced on the ordinary shares for the year ended June 30th last.

United Electric Tramways of Montevideo, Ltd.—Interim dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, is announced on the ordinary shares for the past half-year.

Eastern Telegraph Co., Ltd.—Third quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax.

Western Telegraph Co., Ltd.—First quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1915, being at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets show a good deal of firmness. It may even be said that there is more business about than there was at the end of last month. It has become evident that fortnightly settlements can take place without offering grave menace to markets or credit. The little excitement over the War Loan has unloosed the purse-strings of investors. Brazil Tractions, of the electrical sections, exhibit a marked vitality; the price has risen 4 points since last we wrote. Some of the Telegraph issues are firmer. The coming opening of new stations on the Bakerloo line has made no difference to Underground Electric Railway prices. Supply shares—in the language of the moment—mark time.

The death of a well-known member of the Stock Exchange, from pneumonia, at the beginning of the week, aroused afresh the demand for re-opening the House. Clients themselves are becoming impatient at what they regard as the incomprehensible attitude of the Stock Exchange Committee, although, as a matter of fact, the whole question now lies with the Chancellor of the Exchequer and the Treasury.

The Government seek to impose certain restrictions upon the Stock Exchange (as a condition of giving their consent to reopening of the House), which the Stock Exchange authorities are not at all disposed to accept. One of these is that, in the case of every sale, the seller shall furnish the distinctive numbers of the shares which he wishes to realise, or produce the certificate of the stock, as proof of his ability to deliver to the buyer. Little consideration is needed to see that such a condition would stultify Stock Exchange business to the point of paralysis, although the Government attitude is that such a state of affairs becomes essential if heavy sales are to be prevented on behalf of alien enemies, or of neutral operators instigated by them.

The principle of applying to every market in the Stock Exchange the rule that below certain fixed prices members shall not be allowed to deal with one another, has had the double effect of killing business in the Consol market, while maintaining quotations; and this further restriction runs contra to the business instincts of the House. So many men, however, feel that it is the interest of the State which before all else has to be safeguarded, that they are not prepared to support the occasional agitations which spring up for re-opening the markets, until the financial outlook is so well secured that possible attacks might be awaited with equanimity.

Home Railway stocks are waxing in public favour. There is more inclination on the part of the public than has been noticed hitherto to buy the lower-priced varieties. Metropolitans and Districts are steady at 32½ and 19 respectively, but there is not a great amount of interest taken in either, so far. British Electric Traction issues, too, have been stagnant during the past week. One or two bargains were done in the Debenture stocks; otherwise, there seems to be scarcely anything moving in the Company's issues.

The Manufacturing group is one of the hardest in these sections. On all hands one hears of the way in which electrical manufacturers are full up with orders. Edison & Swan shares have again improved, those with £3 paid rising to 7s., while the fully-paid are ¼ higher at 1⅞. Some of the other electrical manufacturing shares, although in quiet demand, show no particular alteration in price. British Westinghouse Preference gained half-a-crown at 1⅜. Electric Constructions remain steady at 11s. and 20s. for Ordinary and Preference respectively.

It will be noticed by the subjoined list of electricity supply shares that City Ordinary have receded ¼ to 14¾, business having taken place on this basis; while the Preference changed hands between 11½ and 12. London Preference this week have been done at 4⅞. County of London new Preference were picked up at 11⅛. In the Indian group, Calcutta Supply Preference attracted support at 4⅞.

The following is a list of prices of representative stocks and shares in various electrical markets:—

HOME ELECTRICITY SUPPLY COMPANIES.

Brompton Ordinary	8⅜	Kensington Ordinary	7⅞
do. 7 per cent. Pf.	8¾	London Electric	1¼
Charing Cross Ordinary	4⅜	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4¼	do. do. 4 Deb.	89½
do. do. City Pf.	4¼	Metropolitan	8
do. 4 Deb.	86½	do. 4½ per cent. Pf.	4¼
Chelsea	4⅜	do. 4½ Deb.	91½
do. 4½ Deb.	91½	do. 5½ Deb.	81½
City of London	14¾	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	6¾
do. do. 5 Deb.	115	do. do. 5½ Deb.	88
do. do. 4½ Deb.	98	South London	8
County of London	11½	South Metropolitan Pf.	1½
do. do. 6 per cent. Pf.	11¾	Westminster Ordinary	8¼
do. do. 1st Deb.	99	do. 4½ Pf.	4¼
do. do. 2nd Deb.	97		

MANUFACTURING COMPANIES.

Brit. West. Pf.	1⅜	Electric Construction	11s.
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	12¾
do. 5 Pf.	4⅞	,, 4½ Pf.	4⅞
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £3 pd.	7/-	Telegraph Con.	36⅜
do. do. fully pd.	1⅞	Castner-Kellner	2¼⅛
do. do. 4 Deb.	60		
do. do. 2nd Deb.	60		

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pf.	104	Gt. Northern Tel.	29⅜
do. Def.	21	Indo-European	58
Chili Telephone	7	New York Tel. 4½	96½
Constantinople Tel.	4½	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8⅜	do. Pf.	1 7/16
do. Pf.	15⅜	Tel. Egypt Deb.	97
Eastern Extension	11⅝	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1⅛
do. 8% Pf.	72½	Western Telegraph	12⅝xd
do. 4 Deb.	95	,, 4 Deb.	95½
Globe Tel. and T. Ord.	10½		
do. Pf.	12⅝		

FOREIGN TRAMS, &c.

Anglo-Arg. Trams 1st Pf.	4⅛	Bombay Electric Pf.	11
do. 2nd Pf.	4⅜	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	50
do. 4½ Deb.	96½	do. 5 per cent. Bds.	70
do. 5 Deb.	88½	do. 6 per cent. Bds.	70
Brazil Tractions	58	Adelaide Sup. 6 per cent. Pf.	5 7/8
		do. 5 Deb.	102½

The Mexican group remains sickly. Nominally, the prices are unchanged; but, of course, with the Mexican Government holding a pistol at the throat of the Mexico Tramways Company, it can scarcely be expected that anyone will come along to buy either shares or bonds in this division. The Mexican Light and Power Company having passed the interest-payment on its second bonds, it is considered possible that the Pachuca Company may not be able to meet its next coupon; although, as this is not due until April, 1915, the view is certainly premature, if not pessimistic. The Monterey Light and Power Company suspended payment some time ago, of course; and although it has no physical connection with the Mexico tramways group, the company is naturally included, in the mind of the investor, in this division.

British Columbia Electric Railway Preference and Preferred stocks are both 95½; the Deferred has gone back a little to 100. Manila Electric Railroad shares at 82½ have come in for attention. The Cape Electric Tramways report is considered satisfactory. Canadian Electrics are dormant, as are also most of the other electric power and supply corporations connected with Canada, so far as stock markets are concerned. The New York Stock Exchange re-opens for cash business on Saturday in this week, and this may have some reviving effect upon Canadian, as well as United States, securities. The market in American railroad bonds has been open for the last fortnight in Wall Street, and the result is that prices have mostly yielded, where they have moved at all. From this it is inferred that the Germans sell whenever they get the chance to realise their stuff; and the risk of our enemies making Throgmorton Street a dumping-ground for their holdings of stocks and shares is still the chief key which locks the doors of the House.

Most of the leading Rubber shares have given way. Instead of the price of the commodity rising steadily, as it was expected to do, it has shown a tendency to droop; and inasmuch as some of the principal companies are appealing for further capital, the disappointment of shareholders is reflected in orders to sell. The decline has not amounted to much, but it is fairly general amongst the higher-priced shares. Copper issues are steady; and during the past few days there has been noticeable inquiry for tin mining shares, particularly those of companies doing business with the Middle East.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, more or less nominal.

Wednesday, December 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a ,, Nitric	,,	19/-	..
a ,, Oxalic	per lb.	8d.	..
a ,, Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	,,	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	,,	£8 10	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£18 10	..
a Copper Sulphate	,,	£20	..
a Lead, Nitrate	,,	£30	..
a ,, White Sugar	,,	..	..
a ,, Peroxide	,,	..	..
e Methylated Spirit	per gal,	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a ,, Chlorate	per lb.	8d.	..
a ,, Perchlorate	,,	8d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	Nom.	..
a Shellac	per cwt.	55/-	..
a Sulphate of Magnesia	per ton	£12	..
a Sulphur, Sublimed Flowers	,,	£11 10	..
a ,, Recovered	,,	£8	..
a ,, Lump	,,	£8 10	..
a Soda, Caustic (white 70/72 %)	,,	£10 2 6	..
a ,, Chlorate	per lb.	7d.	..
a ,, Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£85	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£112	..
b ,, Sheet, in ton lots	,,	£112	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c ,, Tube (brazed)	,,	9¾d.	..
c ,, (solid drawn)	,,	8¾d.	¼d. inc.
c ,, Wire, basis	,,	8¾d.	..
c Copper Tubes (brazed)	,,	9¾d.	..
c ,, ,, (solid drawn)	,,	9¾d.	..
g ,, Bars (best selected)	per ton	£76	£2 inc.
g ,, Sheet	,,	£76	£2 inc.
g ,, Rod	,,	£76	£2 inc.
d ,, (Electrolytic) Bars	,,	£59	..
d ,, ,, Sheets	,,	£77	..
d ,, ,, Rods	,,	£65	..
d ,, ,, H.C. Wire	per lb.	8d.	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	1 8	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/9½	¾d. inc.
j Iron Pig (Cleveland warrants)	per ton	51/9	9d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£16	..
g Lead, English Pig	,,	£19 15 0	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£11 5 0	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e ,, ,, ,, medium	,,	8/- to 5/-	..
e ,, ,, ,, large	,,	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/6½	..
e Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£65	..
g Tin, Block (English)	,,	£150 to £152	..
n ,, Wire, Nos. 1 to 16	per lb.	2/3	1d. inc.
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

AN ELECTRICAL ANEMOMETER.

This instrument, for the measurement of gas or air stream velocities, eliminates all moving parts at the measuring point and hence eliminates friction and inertia errors; further, it makes possible the indication of the results of measurements at a considerable distance from the measuring apparatus. The principle employed by the latter is not new, but it is now applied for the first time in a thoroughly practical instrument. The change in temperature of an electrically heated conductor placed in the gas stream is determined by electrical measurements, and this change forms a measure of the stream velocity.

Difficulties are encountered in the practical realisation of an instrument based on this principle. For instance, if a thin wire of a material with high temperature coefficient of resistance be arranged in a bridge circuit as in fig. 1 (to permit of delicate resistance measurements), the temperature coefficient of the circuit

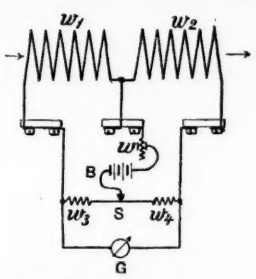


Fig. 1.—W_1, W_2 Hot Wire Branches; W_3, W_4 Constant Bridge Arms.

as a whole is such that a reasonably steady zero cannot be secured in the bridge instrument when the hot wire is loaded to yield suitable sensitivity. One means of overcoming this difficulty is to make the comparison and measuring arms of the bridge as similar as possible in dimensions and materials (and hence in electrical and thermal properties), the two hot wires then being mounted in the two compartments of a shell of good thermal conductivity. Through the chamber containing the measuring wire flows the gas stream under investigation, but the comparison arm of the bridge lies in gas at rest.

In the Siemens-Halske apparatus, however, a "single-chamber" arrangement is employed which is better in many respects than the above two-chamber arrangement. Referring to fig. 2, the two temperature-sensitive arms H_1 H_2 of the bridge are of thin platinum wire and are arranged symmetrically in the plane of symmetry of a thick copper shell K (chosen by reason of its good heat conductivity) so that the air or gas stream passes over the whole of one wire before reaching the other. The former wire is, therefore, cooled (by a stream of given velocity), to a greater extent than the second

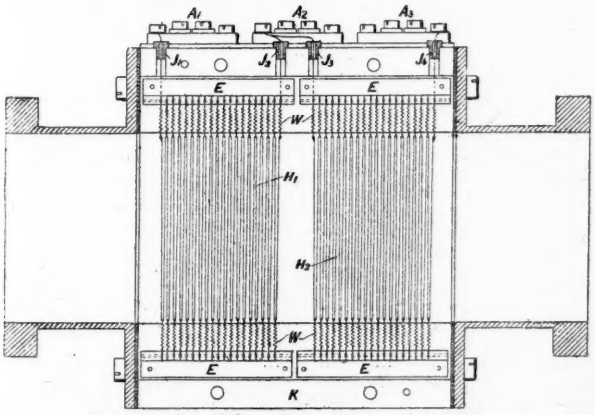


Fig. 2.—Section of Anemometer Chamber.

wire, which is traversed by air already warmed by passage over the first grid. The difference in temperature and hence in resistance between the two bridge arms then depends simply on the velocity of the air stream and, corresponding to a given current through the wires, the bridge galvanometer can be calibrated directly in velocity units. Tension springs W of platinum-iridium wire, attached to insulating supports of ivory, hold the loops of H_1, H_2 in the plane of symmetry (for which the apparatus is calibrated) independently of thermal expansion in the wires. By these it is secured that the zero of the bridge instrument is steady, even when the measuring arm is raised 50° C. above the air temperature; and that the thermal inertia of the hot wire system is negligible, so that instantaneous readings do not differ appreciably from those taken after the hot wires have been exposed for some time to an air stream of given velocity.

The curve between galvanometer deflection and air velocity has the form shown in fig. 3; above a certain velocity the second bridge arm is so strongly cooled that the difference between the resistances of the two measuring arms, having reached a maximum, commences to decrease. At very high air velocities the tendency is for both bridge arms to be cooled to the air temperature. The calibration curve of the instrument is naturally different for different gases, and by varying the size of the hot wires and the electrical loading of the latter, it is possible to adapt the instrument to any range of velocity measurement, but in each particular case the instrument should preferably be used within the range corresponding to the steep part of its calibration curve.

Since the thermal conductivity of gases is independent of pressure down to very small pressures, the sensitivity of the present anemometer is also independent of pressure; the cooling effect depends only on the mass of gas passing over the wires per second, hence the instrument indicates this quantity independently of pressure variations.

If measurements have to be made of the velocity of gas flow in large pipes or of wind in the open, the hot-wire apparatus may advantageously be applied in shunt to a portion of the pipe of known resistance to flow, or it may be piped up to a suitable thrust plate exposed to the air or gas flow. The pressure exerted on the front side and the suction on the back side of a suitably designed thrust plate are proportional to the square of the gas velocity, and under suitable conditions the velocity of flow through the hot-wire apparatus is proportional to the difference between the thrust and suction pressures, and hence to the square of the velocity to be determined. In the practical application of this principle, the greatest part of the resistance flow is concentrated in a temperature valve, which makes possible almost perfect compensation for the effect of temperature on the thrust pressure, internal friction of the gas and the electrical part of the apparatus.

The most important application so far found for the hot-wire anemometer is in the "Anemoklinograph," in which two hot-wire

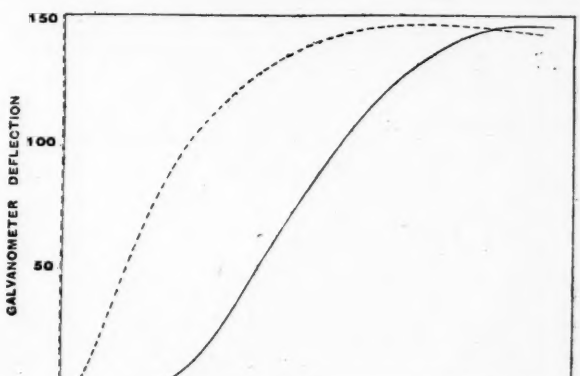


Fig. 3.—Calibration Curves. Ordinates—Galvanometer Deflection. Abscissæ—Full Curve, Velocity (m. per sec.); Dotted Curve, Pressure Difference at Thrust-Plate in mm. of Water.

apparatus are turned (by a wind vane) round a vertical axis, so that the thrust disk on one apparatus always lies normal to the wind. The second hot-wire apparatus is connected to a cylindrical body (also set automatically against the wind) in which are two slots, so disposed that this apparatus is affected only when the direction of the wind departs from the horizontal; its reading then depends on the direction as well as on the velocity of the wind. By taking simultaneous readings with both instruments, the inclination of the wind to the horizontal and its vertical component of velocity can be determined.

The rotary part of the anemoklinograph is provided with a simple electrical device for the remote indication of wind direction, so that all three components of the wind vector can be indicated at a considerable distance from the instrument itself. For the study of wind loads on structures continuous records are desirable, and these are best obtained by the use of three oscillographs recording on a strip of sensitive paper moving at the rate of several millimetres per second. There can be no doubt, says Dr. H. Gerdien in describing the above instruments in *Elektrotechnik u. Maschinenbau*, that these anemometers will prove of great value in investigating problems of aerodynamics and flight.

Electrical Contractors.—In the Parliamentary papers Mr. Boyton asked the Under Secretary of State for War whether he was aware that only a limited number of electrical contractors were being given the opportunity of tendering for Army contracts; and whether he would take steps to see that a wider opportunity was given for the distribution of contracts and consequent employment.—Mr. H. Baker said it was not clear whether the hon. member referred to contracts for electrical stores or for lighting installations. In either case he would be glad to receive from the hon. member the names of the contractors whom he had in mind, as there was every desire to distribute orders as widely as possible.

ELECTRICITY ON THE FARM.

[COMMUNICATED.]

The present is a favourable time at which to extend the applications of electricity on English farms. The winter's work lies before farmers who find themselves short of men and horses yet with good crops and the prospect of a firm home market for all their produce for years to come. Central station engineers are at least no busier than usual, and there is a good opening for electrical manufacturers who are prepared to cater for the special requirements of farmers. Manufacturer, supply authority and farmer surely need each other more, and are better able to meet each others views and requirements than ever before. The writer ventures, therefore, to present notes on the subject which are likely to be of interest to all parties concerned.

The advantages and possibilities of electrical apparatus are fairly well known in a general way to town dwellers and industrial workers, but to the average farmer electricity is a terribly mysterious agency, and the elementary necessity for demonstrating to him that it is a form of energy which he can apply safely, conveniently and economically to his work must not be overlooked. The instant availability of energy in any quantity and the fact that energy is consumed only when actually working are points of special importance to farmers. It is not necessary to depend on empirical data to show the possibilities and advantages of electricity on farms. Many "full size" installations have been made on the Continent and in Canada and the States for serious practical work, and conditions are not so different that the favourable results there obtained cannot be repeated in this country.

Among the duties in which manual labour, horses or oxen, or steam power may conveniently and profitably be replaced by electrical energy are: Chaff and root cutting, pumping, sawing, shearing, milking, grinding, threshing, silo filling and ploughing. To expect a farmer to instal a complete electric power equipment at one fell swoop would be asking too much—unless the farmer happened to be blessed with unusual perspicacity and a fair amount of spare money. In ninety-nine cases out of a hundred the first thing to do is to extend the supply network to the farming area, either from an overland transmission line (of which there are already a respectable number in this country) or from a neighbouring town. This extension should be untrammelled by pettifogging local veto and wayleave questions, and State intervention in this matter and reform of the conditions governing high-tension transmission lines in general would be of immense assistance. Is it too much to hope that in these strenuous times a solution can be found by general consent to this problem which is indeed of national importance?

Assuming that electricity supply be available at the farm gates—and there is no reason why it should not be, if red tape be abolished and a bold policy made possible and followed—the next step is to persuade the farmer to adopt electric lighting and purchase or hire a small "handyman" motor (of 1 or 2 horse-power) mounted on a portable truck so that it can be quickly belted up to any of the machines or pumps already in use in the farm outhouses. The cost of this equipment need not be heavy. As in so many successful Continental and American schemes, the farmer could be supplied through a simple pole transformer, given a certain number of lighting points and a motor—all for a fixed payment—and then he can be told to go ahead. This "contract" system appeals to the farmer. He knows his exact liability and he knows he can use the motor as long as he likes on any work to which he can apply it. Generally speaking, he will not abuse the free hand granted to him (any more than cottage tenants as a class abuse contract lighting arrangements). From existing farm consumption data, from ordinary industrial power supply experience and from a few meters installed purely for checking purposes, any competent supply engineer can determine a contract charge remunerative to the station and fair to the consumer. Black sheep there are in every flock, and the station naturally incurs a little risk, but in return it secures consumers more readily than by any other means and encourages free use of energy at all times and for all purposes. These advantages are cheaply purchased at the cost of occasional losses (usually temporary) on individual consumers. Maximum demand can, of course, be limited as in any other case where contract tariffs are in force. After the handyman motor has been in use for a few months—the farmer's difficulties, if any, having been meanwhile attended to promptly—it will be an easy matter to sell an electric iron to the housewife, to put a small motor in the dairy and one or two stationary motors for pumping and driving countershafting in the chaff and root-cutting shed. A few neighbouring farmers who have thus been educated into the use of electricity should next be approached with a view to their co-operating to hire or purchase one or two large motors for threshing and possibly ploughing, and to lend one another their "right of demand" so that each farmer in turn can take five or ten times his normal maximum demand (the others temporarily taking no current) without incurring any penalty in the way of higher charge per unit. This degree of co-operation is greater than one would have dared to hope for in this country a few years ago, but farmers have lately learnt much of the advantages of co-operation in sugar beet production and the marketing of dairy produce, and the writer refuses to believe that the above scheme for electric farming is impracticable in this country. It has worked admirably in Canada, and there is no reason why it should not do so here. The bringing together of hundreds of thousands of men of all classes in our Expeditionary Forces and their existence and fighting side by side for months or years will have a very potent effect in broadening the national outlook and facilitating co-operative movements in every field.

Power requirements for routine work of daily, or at least frequent necessity on farms, are small, and can be satisfied by small motors and a maximum demand costing little on a contract basis. Typical capacities of miscellaneous farm machinery and the horse-power required to drive the latter are given in Table I:—

TABLE I.—Duty and Power Requirements of Farm Machinery.

	Capacity per 10-hour day.	H.P. required.
Chaff cutter	10 tons	4 to 5
Root cutter	6–7 „	2 to 3
Potato crusher	20 „	1
Oat crusher	2 „	1
Miscellaneous pumps...	100-1,000 gal. per hr.	½ to 1½
Manure mill	30 „	2 to 3
Portable thrasher	200 bushels	3 to 8
Grain cleaner	8–16 tons	1 to 3
Winnower	7–10 „	½
Drum thrasher with cleaner complete	550 bushels	25
Hay and corn hoist	30 tons	1 to 2
Millstones	½–½ „	3 to 4
Band saw or shearing machine ...	—	1
Milking machine	—	½ to 2
Cream separator	1,300 lb. per hr.	1½

In America and on the Continent numbers of electric milking machines have been used for years past. The economic and hygienic advantages are obvious. A 1-h.p. motor is suitable for a byre with 10 cows, and the energy bill for a machine used two hours a day averages £4 per annum (at 1¼d. per unit). The time required to milk each cow cannot be much reduced (for physical reasons) but a number can be milked at once, and 10 to 15 per hour by a man tending three or more milkers at once. Often it is unnecessary to install a special motor for milking.

For threshing in the field the best arrangement is

to take power direct from transmission lines through a covered-in transformer and switch wagon. A small 5-H.P. machine can be supplied with low-tension current through a trailing cable, but the transformer arrangement is much more workmanlike. Hook-poles can be arranged to make contact with the overhead lines, and a meter can be installed on the transformer wagon for checking purposes. Such an equipment should be a co-operative purchase by several neighbouring farmers. There is no real difficulty in making suitable provision for working and in providing adequate safety devices. Organisation, co-operation and departure from past practice are admittedly necessary, and there is no reason why they should not be forthcoming. They will be demanded in many directions in the immediate future, and on them will depend the industrial and economic welfare of the country.

Canadian tests with 25-H.P. threshing machine sets used on the syndicate or party system and working at 20 per cent. average load factor (annual) show a saving of 30 per cent. to 35 per cent. in total costs (including capital charges and depreciation) as compared with steam threshing. In these tests current was bought at 8s. per month plus £7 4s. per H.P. per year (corresponding to 2½d. per unit under the actual conditions—a price which could be at least equalled in this country). Similar economy is obtained by cutting ensilage and filling silos electrically, and the threshing set may be used for this work when not otherwise engaged. For small and isolated farmers the most economical system is to do threshing at odd times during the winter, using quite a small motor and working it when no other electric load is available. The practice of doing the season's threshing and silo filling all at once has grown up largely as a result of shortage of labour; the normal shortage makes it desirable to do all such work while the special harvesting labour is available. Ensilage cutting is an autumn load requiring 2 to 15 horse-power according to circumstances. Still larger equipments are in frequent use in Canada, where a 20-25-H.P. motor cuts and elevates 10-15 tons of ensilage (weighing 30 to 50 lb. per cb. ft.) through 30 or 40 ft., corresponding to from 1,000 to 2,500 lb. of material handled per KW. hour.

Ploughing is the agricultural duty requiring most energy, and hence offering to the farmer the greatest possibility of economy (for cheap power is the first essential to cheap production, and farmers more than industrial workers use manual and horse labour—(both costly), and to the central station engineer the most tempting load (for ploughing extends over five months or so per annum in late autumn and early spring, and is a day load). According to the depth of ploughing and the nature of the soil, horse-ploughing costs from £1 to over £2 per acre. Under favourable circumstances the cost of steam-ploughing should not exceed 15s. or 16s. per acre, but electric ploughing utilises a less expensive form of energy in a cheaper equipment costing less to maintain and often works out at 10s. to 12s. per acre, using current at 1½d. per unit. With current at 2½d. per unit electric ploughing costs 15s. or 16s. per acre, including all costs and charges. These figures represent several years' averages on Italian estates using current at the prices stated. A number of electric ploughing sets similar to steam equipments, except in respect to the driving agent, are in use in Germany, the largest having a 40-H.P. motor and costing little more than half as much as 70-H.P. steam sets, while ploughing practically as much ground per diem (25-35 acres). The lightness of the electrical equipment is a special advantage on soft or hilly ground. Lecler estimates the pull required per ploughshare to be 45, 155, 550 and 1,320 lb. for 2in., 4in., 8in. and 12in. ploughing respectively. The same authority suggests a 12-H.P. electric set, ploughing 2½-3½ acres per diem 12 inches deep, to be the smallest desirable.

Farmers and central station engineer alike must have some idea of the motor horse-power required, the working hours per annum, the amount of energy consumed, and the basis on which it is to be supplied. On all these points more views have been expressed and more data presented than can be dealt with adequately in the space here available. From returns compiled in the Canton of Frieburg it appears that the average working hours per annum per acre on farms of 25 to 90 acres in extent, are for water pumps 100 to 200 hours, stable pumps 40 to 50 hours, and fruit presses 30 to 40 hours. Over and above these demands for which the horse-power is widely variable, from 1,000 to 1,500 H.P.-hours per acre per annum are used in threshing machines (4 to 6 H.P. from 1 to 2½ hrs. per acre); chaff cutters (1 H.P., 60-75 hrs.); root cutters (1 H.P., 30-40 hrs.); potato crushers (2 or 3 H.P., 30-60 hrs.); circular saw, grindstone, corn hoist and so on. Certain farms in the States and those in Germany which use current only for lighting and small power applications, yield a central station revenue of from 7d. to 1s. per acre per annum, but the average German farm adopting electric working and paying say 5d. for lighting. 2½d. for general power, and 1½d. for ploughing supply yields 5s. or 5s. 6d. per acre revenue. This high figure is doubtless attributable to the dense population and intensive farming system, but there is no reason why it should not be at any rate approached in this country.

The total horse-power of motors installed on a farm of given size depends on the class of farm concerned and the extent to which electric working is practised. A 1 or 2-H.P. jobbing motor is invaluable on any farm; 5 H.P. is a useful size for heavier work, and beyond this we reach requirements which can best be met by the party motor and loaned "right of demand" system. Under the latter, a farmer contracts for 2 or 4 H.P. maximum demand (sufficient for the ordinary needs of a 25-75 acre farm, excluding ploughing), and has the advantage of fixed liability, unrestricted use of power (within a contract limit), and occasional use of a 20 or 30-H.P. machine when he needs it for heavy work. No farm is too small to employ usefully a small portable motor; the indoor power required rises in strict proportion to the size of the farm, and the co-operative party motor scheme is equally applicable to a group of small or large estates.

The acute agricultural problem is shortage of labour, and this problem is solved thoroughly and economically by the electric motor. The advantage brought to farmers by the steam thresher and tractor and the small oil engine is made available in more cases and to a greater degree where cheap contract electric service is available. Wind-power is suitable only for intermittent pumping work. Water-power need not be seriously considered in this country. Electric motors supplied from steam turbine stations are more efficient than isolated steam plant, but the small oil engine achieves very low running costs. Nevertheless, the electric motor under a contract tariff can compete even with the oil engine under most farming conditions, and is immensely superior in flexibility and convenience. It must not be forgotten that the number of oil engines in farming service, already great, is ever increasing, and with the improvements in small electric generating sets there is a marked increase in the number of isolated plants installed for electric lighting and small power requirements. Relatively inefficient as it is, when compared with central station service, once an isolated plant is installed it is doubly difficult to persuade the farmer-owner to accept the central station supply and reap the full benefit of electric farming. Even at the cost of a small temporary loss, the farming load should be secured now wherever practicable.

The central station which argues that agricultural loads are unfavourable and not to be courted deserves the worst that can befall it. Every possible

outlet for energy should be sought, and, as a matter of fact, the annual load-curve of a group of farms is surprisingly uniform. Pumping and dairy machinery gives a very useful summer load; fodder cutting is a winter work; ensilage cutting is done in the autumn; and ploughing in late autumn and early spring. As co-operative supply and distributing schemes advance—as they must advance if agriculture is to prosper in this country—there is every reason to hope for the extensive use of the co-operative electric 'bus and lorry—preferably of the battery or petrol electric type, but of the rail-less trolley type on main inter-urban routes. Once electric supply is available to farmers there will be no difficulty in securing lighting and small power connections. Thereafter fresh connections will be chiefly for medium and heavy power applications; the lighting demand will be sensibly constant, but the power demand will increase rapidly.

Looked at from every standpoint, the present seems to be an admirable opportunity for advancing the interests of farmer, central station engineer and electrical manufacturer alike, and the benefit accruing to all parties, including the nation as a whole, will be one of ever-increasing magnitude.

ILLUMINATING ENGINEERING IN WAR TIME.

A general discussion on this topic by members of the Illuminating Engineering Society was opened by Mr. Leon Gaster on Tuesday evening, December 1st. After referring briefly to the important part being played by artificial illuminants in the field, Mr. Gaster took as the main lines of his address the possibility and desirability of learning, from present lighting conditions, lessons which should be applied to improved street lighting when normal conditions were resumed; the possibility of making up by improved interior lighting for the present wretched street conditions; the need for definite official regulations, and the possibility of civil volunteers, expert in illuminating engineering, rendering useful assistance to the police authorities.

The lighting industry did not appear to have suffered by the war as much as might have been expected; demand for "luxury" lighting had fallen, but in many instances this had been counter-balanced to some extent by increased military requirements. The lighting of camps and barracks for the new army represented a respectable total demand, in supplying which electric lamps were used almost exclusively. The improved lighting of rifle ranges was a matter of national military importance; uniform target illumination by concealed lamps was necessary.

To some extent reduced street lighting regulations and methods might be dictated by the desire to economise lighting materials, but chiefly they were designed as a measure of defence—on the one hand making it difficult to recognise streets and their width from above, and, on the other hand, by diminishing sky glow, making it easier to see aircraft from below. The efficiency of reduced lighting was proved by experience at Antwerp. Broadly, lighting had been reduced either by diminishing the power and number of lamps or by obscuring lamp globes so as to block out rays above and restrict illumination below. Great divergence existed between methods and results in various localities, and many speakers pleaded for greater uniformity; it should be remembered, however, that the more illogical the existing diversity, the more perplexing the result as viewed from above.

Anything approaching present lighting conditions had not been seen in London for fifty years past, and it would be a pity if some permanent record of them were not kept. With this end in view, Mr. Gaster announced that permission had been obtained to take an extensive series of photographs and photometric measurements. Leaving some unobscured and unused lamps in position was preferable to obscuring all or removing some, since the former practice provided for comparatively bright lighting in case of fog. Since the war would hardly be over this winter, it was still worth while to alter existing reduced lighting arrangements where desirable.

While emphasising the primary importance of public safety, Mr. Gaster asked whether this could not be secured in many cases by redirecting rays rather than by wholesale reduction in the amount of lighting. The present "spotty" lighting of streets was heinous from the illuminating engineer's standpoint, and was positively dangerous to drivers of high-speed traffic. It would be instructive to have detailed statistics concerning street accidents attributable to reduced lighting, but in interpreting such data, the effect of the reduced amount of traffic and greater care engendered, at least temporarily, by present lighting, must not be overlooked. Existing conditions had done more than any other event in recent years to bring home to the general public the importance of good street lighting and the characteristics of various systems of interior illumination, particularly in shop windows. By exhibiting a number of slides, Mr. Gaster showed that those shops in which the window was lighted as a stage, by concealed lamps, required only top and bottom blinds to comply with police regulations while maintaining full interior lighting. By this time, the lighting of practically all shops must be acceptable to the police, but the enormous difference in effectiveness and custom-drawing value of the actual lighting in individual cases must drive its lesson home to shopkeepers. "Parade" lighting was for the present taboo; when it was resumed it was very desirable that it should be graded off at each end, preferably by extending the parade lighting by lamps of intermediate candle-power. Some of the large illuminated signs now extinguished did not represent the artistic possibilities of this form of illumination; many small signs and illuminated facias could still safely be employed, given suitable simple shading.

The maintenance of lighting material supplies, hitherto largely received from Germany or Austria, was a wide and important problem, in examining which future requirements must be taken into consideration; representations had already been made to the proper authorities with a view to avoiding possible shortage.

The Chairman, Mr. F. W. Goodenough, spoke of the great benefit which would accrue to supply authorities and traders if a system of full window lighting, acceptable to the authorities, were generally employed. In his own show-rooms he had used successfully covered lamps at the top and bottom of windows and corresponding broad bands of blue paper to cut off pavement illumination and upward outward reflection. A peep-show effect with full window illumination was obtained, and the only outgoing rays were horizontal. At normal times, however, good window lighting was no substitute for brilliant parade lighting.

Mr. J. W. T. Walsh (National Physical Laboratory) pointed out that reduction in street lighting had accentuated the danger to other traffic from glaring motor headlights. The present use of tissue paper and similar screens was very inefficient, and the special form of headlight devised by the N.P.L.* with obscuration in one quadrant should be used. It was applicable to any illuminant, and a lamp of, say, 1,400 undiminished c.p. was reduced to 14 c.p. in the obscured quadrant. Mr. Paterson had found that a small metal screen between lamp and mirror reduced the intensity of any headlight without diminishing its directiveness.

Mr. Frank Bailey said that in the City of London alternate lamps were left unobscured for use in fog; to keep them dry and in working order, they were burnt during daylight. In lighting rifle ranges, the back and fore sights should be properly illuminated as well as the target, and there was room for good work in lighting outdoor, longer distance ranges. If done, this would almost double our present rifle training accommodation.

Mr. W. J. Liberty said that street accidents had been reduced in number since the application of the reduced lighting order, but to this result many causes contributed. In the City there had not been one collision with "refuges" during the last three months. The 1¼ million candle-power normally employed for public lighting in the City was now reduced to about ¼ million effective c.p. Central lighting best lent itself to restricted yet relatively efficient illumination. Public lighting represented only about 5 per cent. of lighting companies' output, hence the private lighting problem was much the more important. Under the Order issued last month full interior lighting was permissible up to 6 p.m., and if advantage were generally taken of this, supply authorities would benefit, and the 2½ hours or so of full lighting each evening would do much to improve Christmas shopping and traffic.

Mr. T. Ritchie believed that the results of official observations would show reasonable and reasonably uniform street illumination to be preferable from a military standpoint to the present spotty results. Even a moderate pavement illumination or vertical illumination on walls served to define the width of the street and was, therefore, not permissible. Using 10-amp. flame arcs normally, the speaker had left alternate lamps unaltered, and had reduced the others to half-power by altering their carbon fitments and electrical consumption. Either 25 per cent., 50 per cent., or 75 per cent. of normal lighting was thus possible, the illuminating efficiency being good in each case and the carbon bill materially reduced as compared with obscuration practice.

Mr. A. Cunnington (L. & S.-W. Rly.) said that police requirements concerning the lighting of the Nine Elms goods and shunting yards had been met by obscuring the bottoms of lamp globes up to 30° from the vertical and the tops down to 10° below the horizontal. This cut off upward lighting and eliminated the very bright spots beneath the lamps, but did not materially reduce the vertical illumination on the top edge of marshalled trucks, and that (and *not* horizontal illumination) was what was important from the railway standpoint. Turning out alternate lamps and taking the candle-power 10° below the horizontal as a measure of effective illumination, average electric lighting in suburban streets was still five times as good as in the flat-flame gas burner days.

* See Electrical Review, p. 116, July 17th, 1914.

Mr. J. W. Willcox pointed out the inefficiency of the present system of obscuring lamps; it would be much better to replace arcs temporarily by metal lamps of lower c.p. The only shop windows at present lighted effectively were those using concealed reflector lamps; in such cases, window bands or the mere lowering of an awning complied with police requirements.

Mr. MacIntyre (Board of Works), while regretting his inability to discuss the measures taken by his Department, agreed that the results obtained in restricting lighting should afford valuable assistance later on in improving normal lighting. In connection with the lighting of rifle ranges, he pointed out that a man trained on a perfectly-lighted range might find his marksmanship imperfect under dusk conditions, hence imperfect range illumination was not an unmitigated evil.

Mr. R. C. Bussell emphasised the danger to motorists of incandescent gas lighting on the old short standards first on one side then on the other of suburban streets.

In replying, Mr. L. Gaster again urged the desirability of members in various districts being permitted to render assistance in illumination problems which were certainly outside the ken of the police.

INSTITUTION OF ELECTRICAL ENGINEERS.

On November 18th Dr. A. H. Railing, Chairman of the Birmingham Local Section, delivered his inaugural address, taking for his subject the position of electrical engineering in the world's social organisation. His aim was to show how and why the advent of the electrical engineer of necessity had been a late one, and how he therefore represented one of the most highly developed "organisms"; upon him there fell the duty of using the accumulated experience of the intermediate formations for the purpose of achieving further progress. With this object in view, the Chairman reviewed the history of mankind from the days when man's original occupation was that of a hunter, and his preoccupations were the finding of food and self-defence. The development of agriculture and the combination of individual households into tribes relieved the pressure of the above-named functions and enabled the individual to specialise and to develop arts and sciences. The trader came into existence, and provided means of communication which facilitated the efficient use of commodities by exchange, and mankind learned the use of materials, while the study of dynamics and the problems of matter prepared the way for the development of electrical engineering, by a logical progression from the physical properties of matter in bulk to the properties of the molecule, and onwards to those of the atom and eventually of the corpuscle. The knowledge of all these problems and the application of such knowledge went hand in hand, efficiency continually increasing, while development proceeded from visible matter and the energy of visible matter further and further into the region of the invisible and infinitesimal. Thus, "in engineering we came last to the science of the corpuscle, and its application, electrical engineering."

Having thus traced the origin of electrical engineering, Dr. Railing proceeded to inquire "In how far has electrical engineering already contributed to human development, by, shall we say, improving human progress and efficiency?"—and stated that it was a power for civilisation if it increased mankind's efficiency by making better use of matter and of available energy, by increasing the space that could be inhabited by man, by increasing the physical or mental power of each individual, and by increasing the efficiency of human society.

In proving that the influence of electrical engineering had been effective in all these directions, he first pointed out that the study of electricity had revealed the fact that all elements were either interwoven with or composed of a variety of corpuscles, and that all energies were reduced to one, namely corpuscular energy—electricity. All the other energies were variations, and electricity, the youngest child of natural science as we knew it, "must be recognised as the mother of all others—optics, dynamics, chemistry, perhaps of psychology, biology." The achievement of a common basis, together with the other results, enabled us to transform all forms of energy into one another, to transform combinations of elements, and, perhaps one day, to transform the so-called elements, besides enabling us to make use of available free energy at pleasure. For the latter purpose electrical energy was the most suitable form, owing to the ease with which it was "generated" at the source of energy, transmitted to the places where it could be usefully applied, and re-transformed into all the various forms of energy used by mankind, or stored for use at a different time. Thus the limited amount of free energy in our system could be most efficiently utilised independently of time and place.

Taking the four advantages above-named *seriatim*, Dr. Railing divides available energy into kinetic and chemical energy, and says that the transformation of kinetic energy, as in water and wind, into electrical energy is ideal. The efficiency of transformation of chemical energy is still low, and it is to be hoped that ways may be found to convert the energy of radiation direct into electrical energy without the intermediate steps of heat and mechanical energy. There are numerous industrial processes in which intervention of electrical energy results in higher overall efficiencies.

The transmission of electrical energy can be accomplished with a higher efficiency than that of any other form of energy. Transmission by electro-magnetic radiation may become practicable and offers an excellent field for research.

The applications of electricity to the efficient production of light and heat, without creating fumes, without delay in starting and stopping, and under easy control, are well known. The electrical production of exceedingly high temperatures in confined space has given us aluminium, calcium carbide, carborundum and graphite, besides enabling us to make high-class steel, to melt quartz, and to weld metals. The electrolytic refinement of metals, electroplating and other electrochemical processes, have had immense results, and from the nitrogen of the air we make fertilisers to augment the growth of plants which we can assimilate in our human organism so as to replace the free energy which we spend. "Only when we look closely into transformations of energy such as the one just mentioned, does it become clear to us that such a series of tremendously complicated transformations can only be performed by an extremely fine transmission apparatus, with energies highly concentrated in small masses, and that the dynamic energy of larger masses could hardly undergo such transformations without tremendous loss and consequent inefficiency."

The transformation of electrical energy into mechanical energy leads us into practically every sphere of human activity. We can concentrate or sub-divide it without limit, and control it with ease. Amongst the effects of these advantages are the cheapening of coal, iron and steel, cotton goods, etc., and, broadly, by cheapening raw materials and finished products, they have increased individual and average comfort of living, while the application of electrical energy for transportation has reduced the dead weight of material in motion, improved the mechanical conditions and increased the speed of transit, widening the area which can be inhabited by mankind. Electricity also enables us to equalise climatic conditions, to irrigate dry territories, to build canals and to reclaim swamps; and electrical engineering is a factor in civilisation by increasing the efficiency of the individual.

The knowledge of electrical matters, and especially the theory of the corpuscle, have enabled us to prove existing laws in organic matter, to ascertain how our senses respond to external and internal stimuli, and to establish the fact that in the human body the receiving and transmitting mechanisms are of partly electrical nature. Problems of memory, inheritance and telepathy have been attacked by means of the vibration of electric corpuscles. The uses of electrical engineering to diagnose and cure disease, and to enable us to see and reach internal tissues, must be mentioned. "Electrical engineering thus, in mastering matter, is trying to probe into the mechanism of living organism and problems which concern man's body and mind." These endeavours must result in the increased efficiency of the individual.

Electrical engineering has acted as a great democratising agent; it has replaced to an ever-increasing extent manual labour by the use of other available energies, setting free mankind to spend more in the form of mental energy; and by telegraphic transmission it has facilitated the dissemination of knowledge throughout the world.

"I think, though the picture is not complete, I have shown that electrical engineering has led to better understanding, a more extended use and a more efficient use of nearly all existing matter and energy. It has led to a better understanding of animal and human organisms and problems. It has bridged space and time and minimised their influence where they become resistance factors against energies mental and physical, it has increased the efficiency of individual and society, it has, therefore, established its claim to be one of the most valuable factors in the progress of mankind.

"For the electrical engineer, never mind how small and how apparently unimportant his specialised work may often seem to him, this knowledge should be a profound source of satisfaction and happiness and a spur to increased activity."

THE THERMOPHONE.

By M. de LANGE.

(*Abstract of paper read before the* Royal Society *on Dec. 3rd.*)

The invention has been made by me in co-operation with my friend Otto Fischer. Some of the models have been made in the laboratory of the University of Utrecht by the assistant, Mr. Stellema, under the supervision of Professor Zwaardemaker. I have been demonstrating with these models for over six months, and they do not show the slightest wear.

The origin of thermophones may be traced back to the invention made 34 years ago by Sir William Preece (Proceedings of the Royal Society for 1880, No. 204), who connected a thin platinum wire with a diaphragm and thereby succeeded in reproducing sound waves of the human voice on the diaphragm.

Sir William Preece, however, kept his invention connected

with a mechanical operation of a wire which, by extending and retracting, worked upon the diaphragm and thereby made the diaphragm speak. The thermophone is not connected with a mechanical operation of a wire, but simply and solely rests upon a change of temperature in a wire which is not attached to any diaphragm whatsoever. In the thermophone the wire speaks without a diaphragm.

About seven years ago, the Russian engineer Gwozdz made various experiments with a thermo-telephone without a diaphragm and without an electromagnet. He placed a Wollaston wire in an insulating medium, and then treated the wire with acid. He obtained thereby a good thermophone, but (as far as I know) it was impossible by this process to obtain thermophones which conveyed the required volume of sound, and Gwozdz never succeeded in rendering the thermophone of any practical utility.

At the same time Professor Abraham, of Paris, made some experiments with a thin platinum wire which he connected with electrodes in a straight line, and then again with a transmitter. These experiments also did not meet with a practical result, because the stretched wire had no freedom, and thereby was exposed to too great a danger of breaking by the alternate extensions and retractions.

With my invention I follow the process of Gwozdz regarding the treatment of the Wollaston wire, but I claim that my invention is of the greatest practical value. By fixing a wire of a diameter of from 2 to 12 microns in a Gothic curve I claim to have succeeded in making the thermophone of practical every-day use, because the silver of the Wollaston wire is eliminated whilst the whole Wollaston wire is freely suspended in the acid in such a way that at any time such part of the platinum wire can be set free as is considered desirable, without its being liable to breakage.

Thermophones have value only if they have been made on this basis.

Prof. Zwaardemaker and myself have measured the volume of the sound with Lord Rayleigh's well-known mirror. In order to avoid currents of air which might originate by the increase in heat of the wire, we placed a glass membrane in a wooden or aluminium cover between the wire and the mirror. The size of the membrane was about the same as that of a membrane of the phonograph. Moreover, we placed a small tube in the cover of the membrane in order to prevent the system from working as an air thermometer.

The result of our measurement was that the sound increased with the increased number of platinum wires, but not in the same ratio. Thin wires of two microns have a greater acoustic effect than wires of 5 microns, the Joule heat remaining the same.

Everything depends upon the exact relationship between the telephone and the microphone.

The thermophone, listened to in the open air, sounds extremely weak.

As soon, however, as the platinum wire is placed under a cover which has a small opening, or several small openings, the sound at once becomes clear and distinct. The volume of the sound increases in accordance with the decrease of the size of the cover. Evidently the cover functions as a resonator. It is a telephonic advantage to make the cover as small as possible, because in that case the high notes and the sound consonants produce a better effect. The size of the opening in small covers should not be made too large, because in that case the resonance becomes too high and produces a curious sound in addition to the human voice.

The maximum size of the cover appears to range between comparatively speaking wide limits. The size which approximately agrees with the size of the human ear funnel seems to be most suitable. Metal covers are better than those of ebony, and by surrounding these with some cooling substance the acoustic effect becomes twice as great. In this case the sound is conducted through a rubber tube of small width.

It is quite possible to combine a number of these thermophones, but then it should not be forgotten that the whole space occupied by them should remain as small as possible, because the space which they take up together also acts as a resonator.

The acoustic effect appears to increase at least as about the square of the strength of the current.

Thermophones with four rows next to each other, each of 6 platinum wires of 7 microns with a resistance of 35 ohms give—measured with Lord Rayleigh's mirror—the following results, viz. :—

In the case of	6 volts	2½ points.
In the case of	8 volts	15 points.
In the case of	10 volts	25 points.

It is difficult from these items to construct the theory of the thermophone.

The most I can say is, that the decrease and increase of heat in the platinum wire of the telephone takes place isochronously with the vibrations in the microphone. The air surrounding the platinum wire is thereby heated or cooled in accordance with the increase and decrease of heat in the wire and, if that air is retained within a closed compass by the cover, the expansions and retractions will be noticed as sound.

Dr. Glazebrook elicited that the thermophone was employed as a telephone receiver, an ordinary microphone being used as a transmitter, and, in reply to Mr. Duddell, it was stated that in the demonstration the battery was directly in the line circuit.

CABLES.

By C. J. BEAVER, M.I.E.E.

(*Concluded from page* 770.)

In the earlier stages of the investigation into the deterioration of vulcanised bitumen insulation it was proved that the physical changes were not due to anything of the nature of spontaneous or chemically induced de-vulcanisation. In the light of experimental reproduction of the softening effects produced by the combined agency of heat and moisture (steam), hydrolysis of the glycerides of the fatty and hydroxy acids contained in the vulcanised bitumen was clearly indicated. The results of analysis of the softened material, and a comparision thereof with the results obtained with the original vulcanised bitumen, confirmed this indication.

The general nature of the decomposition by hydrolysis is similar to that by saponification, except that in the former the fatty acids are not combined with an alkali and therefore do not form soaps. This throws some light on the indiscriminate occurrence of the former type of softening on cables of any polarity and on alternating-current cables, and the restriction of the latter type to negative continuous-current cables.

The ultimate object of the study of the softening effects was naturally to find and provide some means of obviating them; and in view of all the facts brought to light by investigations *in situ* and experimental work, the best direction in which to work was obviously one in which protection would be afforded to the susceptible components of the material. Some form of colloidal filling having the requisite physical properties to allow of its incorporation with the vulcanised bitumen, of such composition as not to be capable of decomposition by hydrolytic action, and which at the same time would exert a maximum protective effect when present in small proportion, was clearly the ideal. After much experimental work it was found that high-grade vulcanised rubber could be treated in such a manner that it would fulfil the requirements as regards incorporation with vulcanised bitumen, and would in addition exert a surprising degree of protection against hydrolytic and selective action, even when used in small proportions. In fact, there was apparently some kind of mutual protective action, because the resistance to softening under steam-pressure conditions was greater in the combined substance than in either of its components.

Fig. 13 records graphically the results of a series of tests on the degree of protection afforded by various percentages of vulcanised rubber when subjected to steam at a pressure of 40 lb. per sq. in., the softening periods being determined by observation. It will be seen that the addition of about 6 per cent. of vulcanised rubber trebles the time required to produce the softening, and that up to about 12 per cent. the time is

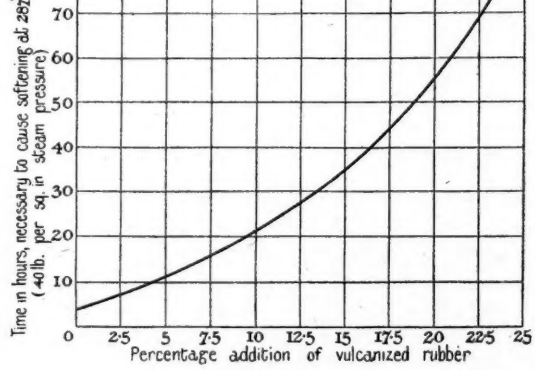


Fig. 13.

proportionately increased. When larger proportions are used the curve rapidly becomes steep, and at 40 to 50 per cent. the protection from softening effects appears to be infinite. Remembering that the softening action only occurs under faulty conditions and requires five or six years to develop to a troublesome stage, the protection afforded by 5 to 10 per cent. of the rubber substance would appear to be ample under the worst conditions of practice.

The author feels sure that there are a large number of engineers who will derive some satisfaction from the assurance that the troubles referred to are not inherent in the type of cable, but are attendant on fault conditions which should seldom occur, and which would equally produce some kind of trouble on any other type of cable.

Lyons's Lifts.—The new Strand Corner House of Messrs. J. Lyons & Co., Ltd., now in course of construction, is being fitted with two express lifts by Messrs. A. W. Penrose & Co., Ltd.

POWER PLANT TESTING.

By W. M. SELVEY, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November 26th*, 1914.)

In the early "electric light" days the largest item in the cost of power was the "interest and depreciation" in connection with the capital cost of the plant installed. At that time the correct policy was to instal cheap plant that was relatively inefficient, provided always the price of the plant was not cut down at the expense of reliability.

The experience that the more successful undertakings are now passing through is of another kind. Time has shown that owing to the rapid advances in thermodynamic efficiency of power plant an item, which is now termed obsolescence, was omitted from the old balance sheet. Recasting the balance it is now seen that this item stands out prominently compared with the real interest and depreciation, which are essentially of a different nature. This item is large, not only when compared with generating-station costs, but also with distribution costs.

It is the author's opinion that unless provision is definitely made for replaceing obsolete plant out of revenue, no longer than eight to ten years should be allowed for complete

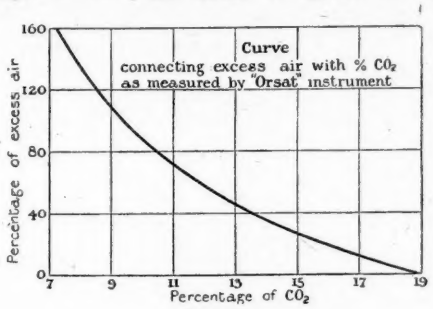


Fig. 1.

obsolescence of plant purchased at the present time and rated at less than 5,000 kw. in the case of turbo-alternators, or 30,000 lb. per hour for boilers.

Within the next ten years the past, and to a large extent the present, significance of load factor will have disappeared. Further improvements which will subsequently be obtained when the load factor is 50 per cent. will not be a vital matter in the cost of generating electrical energy. The expression

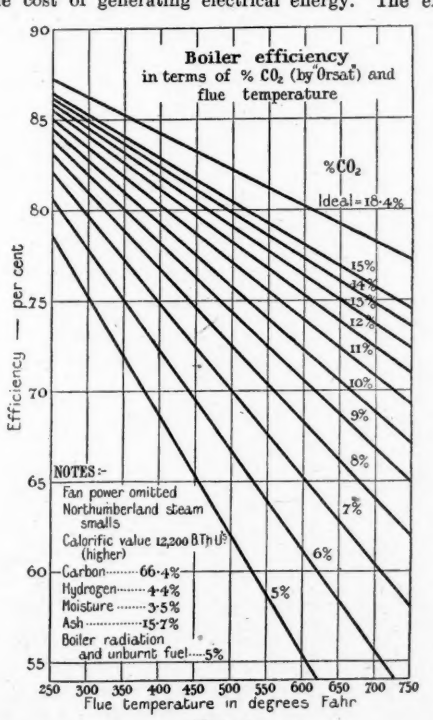


Fig. 2.

will still be of use, but its point of application, so to speak, will have moved even past the sub-station and be much nearer the consumer's terminals.

It is owing to these facts that the system known as the bonus or penalty clause has become the leading feature in the purchase of power plant.

Take a turbo-alternator set having a maximum continuous load of 10,000 kw. and a most economical load of 7,500 kw., and which is to be used on a system where on the average it will be loaded to 7,500 kw. for 8,000 hours per annum. The number of kilowatt-hours generated by this machine is 60 million per annum. A variation of 1 per cent. in this output, taken on a coal cost of 0.15d. per unit, is £375 per annum. Capitalised on the basis of eight years' life, this is equivalent to £3,000. Thus, of two competing machines, if one has a steam consumption of 12.5 lb. per kilowatt-hour and is offered at £25,000, and the other has a consumption of 11.5 lb. per kilowatt-hour, *i.e.*, 8 per cent. better, the second machine would be worth £24,000 more than the former. The actual difference in the cost of manufacture, however, would not be more than £2,000 to £3,000. These figures, though intentionally approximate, are near enough to compare with various bonus and penalty clauses which have been effected from time to time, and large sums of money now depend on the accuracy of test figures which may easily be from 3 to 4 per cent. wrong, while the actual sums are often given in terms of one-tenth of a pound of steam per kilowatt-hour—that is to say, less than 1 per cent. of the total consumption.

There are several firms who are endeavouring to utilise every possible advance in efficiency in the design of their machines, but are compelled at the present time to quote prices that do not in any sense take into account the actual efficiency obtained.

The value of 1 per cent. of the output must also be taken into account in the boiler-house.

Boilers and Economisers.

The efficiency of boilers has received much attention of late years. The ideal percentage of CO_2 in the flue gases varies with the ratio of hydrogen to carbon in the coal, but in most English coals the variation is not more than will cause the ideal amount of CO_2 to vary from 18 per cent. to 19 per cent.

A modified form of Orsat apparatus has been developed for readily analysing the sample taken. The method of collecting the sample shown in fig. 3 will be found to give reliable results. A considerable stream of gases is drawn through a

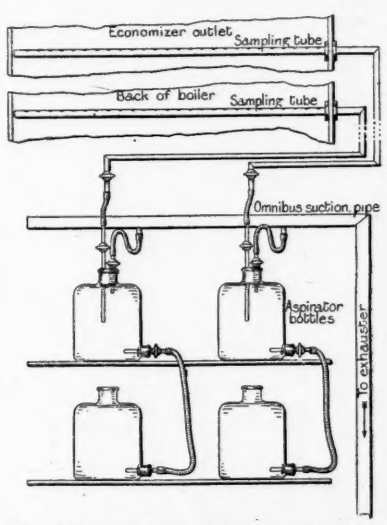


Fig. 3.—Apparatus for Sampling Flue Gases.

sampling pipe, perforated with many fine holes right across the flue, together with aspirators capable of drawing off a steady fraction of this main stream. A little Roots blower, or, what is still simpler, a small steam ejector, is employed for this purpose. The other main measurement which determines the efficiency of the boiler is that of the final temperature.

The author has for some years used platinum—platinum-rhodium couples for the higher temperatures, and copper—copper-constantan couples supplied by the Cambridge Scientific Instrument Company and checked at the National Physical Laboratory. The results have been entirely satisfactory, particularly when the wires are insulated with the Vitreosil product of the Thermal Syndicate.

These two measurements having been established, there are only two important unknowns, namely, radiation and unburnt fuel; these the author has studied in considerable detail.

As regards radiation, the loss is no more than 3 per cent. in a 20,000-lb. boiler well lagged, and it may be taken as 2 per cent. in a 30,000-lb. boiler and larger sizes. Excessive radiation is always easy to locate, and not difficult to remedy. The loss by unburnt fuel can certainly be reduced to 10 or 15 per cent. of the ashes, and may therefore be taken as 2 per cent. In fig. 2 5 per cent. has been allowed for these two losses.

The author has so far not seen a stoker and furnace construction that does not suffer either in efficiency or upkeep if the coal is either too bad or too good. If the boiler is designed for a good coal, giving anything above 12,800 B.Th.U. as fired, or below 8 per cent. of ash, it cannot maintain com-

bustion at all with some coals. If, on the other hand, the boiler is designed for a bad coal (11,000 B.Th.U. or less as fired, or above 16 per cent. of ash) the temperatures attained when working at its best, and with good coal, are such as no brickwork will stand. The best working can only be got by keeping the quality as uniform as possible, and this is the real difficulty.

The author has, while testing a sample 10-ton truckload of coal on a 100-sq. ft. grate, found the amount of CO_2 to drop from 14 to 8 per cent., and the evaporation from 30,000 lb. to 18,000 lb. per hour.

With a stoker and furnace specially designed for coal with a very high proportion of duff, with which only 8 per cent. of CO_2 could be got with great effort, a run of good coal has softened the arch and made the walls "run in" in less than an hour.

It is comparatively easy to produce an amount of CO_2 ranging from 12 per cent. to 14 per cent. on a chain grate with a long arch when the duff is not above 30 to 40 per cent.; but when this rises above 60 per cent. it has an extraordinary blanketing action on the fire, and it is difficult to keep the amount of CO_2 up to 8 or 9 per cent., even under test conditions. To sum up, an average of 10 per cent. would be exceedingly good working at the boiler exit. The amount of CO_2 at the economiser exit is often 2 per cent. lower, and this difference is one that will repay close attention.

It is well to separate as far as possible the known bad coals, and to burn them on a specially arranged furnace adapted for such types of fuel. A scheme something like this has been adopted at Birmingham for the riddlings.

The size of the economiser has a large effect on the final temperature. The temperatures on full load should be taken, say, 24 hours after sweeping, and should be used as a standard. If at any subsequent time the boiler exit temperature is found to be 150° F. higher, or the economiser outlet to be 100° F. higher, the boiler needs cleaning.

Values of 600° F. for the former and 350° F. for the latter may be considered satisfactory. The lowest temperatures that the author has met with are about 450° F. for the boiler outlet, and 240° F. for the economiser outlet. A result of, say, 10 per cent. CO_2 and 300° F. final temperature at the economiser outlet may be considered a good test result. Close supervision in the boiler-house will pay, not during morning and evening peaks when conditions are at their best, but at the times of light load and during the night.

(To be continued.)

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,887. "Telephone receivers." J. W. Greenwood. November 23rd.

22,893. "Magnetic clutches." F. Newton & Newton Bros. November 23rd.

22,897. "System of control for maintaining the relative speeds of a number of electric motors." F. C. Anderson & C. A. Atchley (trading as Harland Engineering Co. November 23rd. (F. G. Warburton, Canada.)

22,906. "Telephone-call recorders." D. J. McGauran. November 23rd. (Complete.)

22,913. "Illuminating devices." British Thomson-Houston Co., Ltd. November 23rd. (General Electric Co., United States.)

22,914. "Operation of polyphase electric motors in connection with single-phase alternating currents." B. G. Lamme. November 23rd. (Convention date, December 26th, 1913, United States.) (Complete.)

22,915. "Electrically-heated shaving pots." A. J. Miller & G. A. Miller. November 23rd. (Complete.)

22,927. "Apparatus for operating electrical devices at a distance." Siemens & Halske Akt. Ges. November 23rd. (Convention date, November 21st, 1913, Germany.) (Complete.)

22,930. "Shaving pots." A. J. Miller & G. A. Miller. November 23rd. (Complete.)

22,931. "Methods of manufacturing electric condensers. Galvanophoren-Werke (System Vogt), S. Szbert Kommanditges, & Vereinigte Elektricitats-werke G.m.b.H. November 23rd. (Convention date, November 22nd, 1913, Germany.) (Complete.)

22,936. "Regulating devices for electric polyphase shunt commutator machines." O. Imray. November 23rd. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

22,937. "Repeaters for use in telephone lines." A. H. Olsson & H. B. M. Pleijel. November 23rd. (Convention date, December 2nd, 1913, Germany.) (Complete.)

22,940. "Measurement by the use of sound waves." R. A. Fessenden. November 23rd. (Convention date, April 2nd, 1914, United States.) (Complete.)

22,950. "Air filter for turbo-dynamos and the like." Allgemeine Elektricitats Ges. November 23rd. (Convention date, November 21st, 1913, Germany.) (Complete.)

22,958. "Construction of direct-current dynamos required to generate approximately constant voltage when driven at variable speeds." W. D. Hills. November 24th.

22,989. "Controlling-arrangements for electric motors." C. B. Burdon. November 24th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

23,013. "Electrical signalling systems." C. B. Kersting. November 24th.

23,027. "Attachment of electrical conduit tubes to junction pieces." T. A. Smith & W. H. Owen. November 25th.

23,049. "Reflectors for electric incandescent lamps." F. W. Suter and Baxter & Caunter, Ltd. November 25th.

23,050. "Looped-in system of electric wiring and fitting therefor." F. W. Suter and Baxter & Caunter, Ltd. November 25th.

23,071. "Electric measuring-instruments." F. Holden. November 25th.

23,075. "Regulating-means for electrical installations." Soc. Anon. des Etablissements L. Blériot. November 25th. (Convention date, November 26th, 1913, Belgium.) (Complete.)

23,090. "Electric drilling or cutting apparatus adapted for use in ship-building or such like work." J. Clark & W. G. H. Graham. November 26th.

23,102. "Lanterns for electric lamps." W. S. Johnston. November 26th.

23,107. "Electrical switches." F. B. Cox. November 26th.

23,113. "Electric incandescent lamps." E. Terry. November 26th. (Complete.)

23,121. "Vibrating rectifiers for electric currents." British Thomson-Houston Co., Ltd. November 26th. (General Electric Co., United States.)

23,122. "Vapour electric devices." British Thomson-Houston Co., Ltd. November 26th. (General Electric Co., United States.)

23,136. "Electric incandescent lamps." Westinghouse Metallfaden Gluhlampenfabrik G.m.b.H. November 26th. (Convention date, November 29th, 1913, Austria.) (Complete.)

23,142. "Magneto-electric machines particularly for ignition purposes." H. Wade. November 26th. (C. T. Mason, United States.) (Divided application on 967/14. January 13th.) (Complete.)

23,154. "Holders for electric incandescent lamps and the like." J. H. Woolliscroft. November 27th.

23,156. "Pipe and electric cable saddles, clips, and the like." A. G. Bullen. November 27th.

23,167. "Telegraph circuits." A. Orling & Orling's Telegraph Instruments Syndicate, Ltd. November 27th.

23,168. "Magnetic electric alarm." W. Minter. November 27th.

23,170. "Electric sound for detecting presence of metallic bodies in living animal tissues." D. Findlay. November 27th.

23,171. "Control of electric motors." A. H. Curtis, E. W. Short, & Igranic Electric Co., Ltd. November 27th.

23,182. "Electric accumulators." G. Fuller, L. Fuller, & G. J. A. Fuller. November 27th.

23,189. "Apparatus for charging electric accumulators." H. F. Joel, Sen. November 27th.

23,211. "Electric bells or gongs." F. F. MacDonald. November 28th. (Addition to 7,638/13.)

23,212. "Electrical coupling devices." G. St. J. Day. November 28th.

23,231. "Track switches for electric transporters, trolleys, and the like." R. D. Hulley & E. A. Claremont. November 28th.

23,236. "X-ray apparatus." H. W. Cox & Co., Ltd., & H. E. Donnithorne. November 28th.

23,238. "Electric batteries." F. J. Beaumont. November 28th.

23,242. "Electric starters for use on motor-cars and the like." A. H. Midgley & C. A. Vandervell. November 28th.

23,245. "Electric switches." M. D. Scott. November 28th.

23,249. "Cooling dynamos, motors, and other electrical machinery." C. H. Lauth. November 28th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

22,198. Connecting up of Electric Cables or Conductors, and the Protection of their Exposed Ends and Terminals in Systems of Wiring for Building and the like. St. Helens Cable & Rubber Co., and J. C. White. October 2nd.

25,184. Electric Clocks. Nu-Lines Manufacturing Co. & C. C. Chapman. November 4th.

25,210. Miners' Electric Safety Lamps. J. G. Patterson. November 5th.

25,531. Construction of Sparking Plugs for Internal-combustion Engines. E. A. H. de Poorther. November 7th.

25,717. System of and Apparatus for Recording Electrical, Chemical, Mechanical, Physical and other Quantities. M. E. Leeds. November 10th. (November 22nd, 1912.)

25,833. Electric Switches. F. B. Holt & H. Smith. November 11th.

25,928. System or Apparatus for the Distance Control of Motors. A. Mond (Maschinenfabrik Oerlikon). November 12th.

26,582. Process and Apparatus for Forming Welded Electric Contacts Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). November 19th.

26,608. Selective Signalling Devices. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). November 19th.

26,619. Apparatus Communicating Signals to Trains whilst Running. J. J. Sullivan & H. R. Hughes. November 19th.

27,063. Resonating Relays. H. Von Kramer & G. Kapp. November 24th. (Addition to 10,856/11.)

28,557. Keyboard Tape Perforator. D. Murray. December 11th.

29,504. Dynamo Electric Machines particularly adapted for Starting Prime Movers. H. Pieper. December 22nd. (December 28th, 1912.)

1914.

103. Pole Compasses for Ships. A. Jefferson. January 2nd.

390. Dynamo-electric Machines. British Thomson-Houston Co. & A. A. Pollock. January 6th.

2,301. Electric Safety Fuses. H. H. Berry. January 28th.

3,643. Construction of Electric Pocket Lamp Dry Batteries and Outer Shell or Case containing the aforementioned dry batteries. J. S. Hamilton. February 12th.

4,344. Dynamo-electric Machines. E. C. Ketchum & D. H. Andrews. February 19th.

5,587. Means for use in Supporting Separator Diaphragms used in Storage Batteries. Electrical Power Storage Co. & R. Rankin. March 5th.

16,839. Telephone Apparatus. E. A. Graham. July 15th.

19,282. Recording Apparatus. M. E. Leeds. August 31st. (Divided application on 25,717/13. November 10th.) (November 22nd, 1912.)

19,283. Electrical Potentiometers. M. E. Leeds. August 31st. (Divided application on 25,717/13. November 10th.) (November 22nd, 1912.)

21,968. Miners' Electric Safety Lamps. November 3rd. (Divided application on 25,210/13. November 5th. J. G. Patterson.

A Blackpool Exhibition.—Amongst the electrical trade firms who are exhibiting at the Blackpool Traders' Exhibition, now in progress, are Messrs. Bottomley, Frampton & Co. and Messrs. Jones Bros., both of Blackpool.